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NFPA 1983

Standard for Fire Service Life Safety Rope and System Components

2001 Edition

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NFPA 1983

Standard on

Fire Service Life Safety Rope and System Components

2001 Edition

This edition of NFPA 1983, *Standard on Fire Service Life Safety Rope and System Components*, was prepared by the Technical Committee on Special Operations Protective Clothing and Equipment, released by the Technical Correlating Committee on Fire and Emergency Services Protective Clothing and Equipment, and acted on by the National Fire Protection Association, Inc., at its November Meeting held November 12–15, 2000, in Orlando, FL. It was issued by the Standards Council on January 13, 2001, with an effective date of February 9, 2001, and supersedes all previous editions.

This edition of NFPA 1983 was approved as an American National Standard on February 9, 2001.

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Origin and Development of NFPA 1983

The Technical Committee on Protective Equipment for Fire Fighters (then renamed as the Technical Committee on Fire Service Protective Clothing and Equipment) began work on this standard in 1982 in answer to requests from the fire service to establish requirements for rope used by the fire service to perform rescues. During the development of this standard, it became necessary to include harnesses and hardware that are used with the rope in rescue operations. The work was completed in the spring of 1984 and submitted to NFPA for official adoption. The first edition was issued on June 6, 1985.

The Subcommittee on Life Safety Ropes began the revision to the 1985 edition in late 1987 and turned over its proposals to the Technical Committee in December 1988. The Technical Committee completed its work on the document in April 1989, and it was submitted for the Annual Meeting 1990 cycle. The second edition was issued on July 20, 1990.

During 1993, NFPA restructured the manner in which committees were organized, and all standing subcommittees were eliminated. Within the Technical Committee on Fire Service Protective Clothing and Equipment, the former standing subcommittees were reorganized as task groups to address specific technical issues, and the Technical Committee assumed the entire responsibility for NFPA 1983.

In October 1994, just after the revisions for the third edition were completed, the Standards Council appointed the Technical Correlating Committee on Fire and Emergency Services Protective Clothing and Equipment to oversee all fire and emergency services protective clothing and equipment issues. The existing Technical Committee on Fire Service Protective Clothing and Equipment ceased to exist in May 1995, and seven new technical committees, each responsible for a different segment of the fire and emergency services protective clothing and equipment spectrum, are now in place. The future responsibility for NFPA 1983 now rests with the new Technical Committee on Special Operations Protective Clothing and Equipment, operating under the Technical Correlating Committee on Fire and Emergency Services Protective Clothing and Equipment.

The third edition of NFPA 1983 was a complete revision to the document. The document was reformatted to present the certification requirements, the product labeling and user information requirements, the design requirements, the performance requirements, and the testing requirements each in separate chapters. A different approach was taken to life safety rope and the various items used in conjunction with the rope. While the life safety rope remained as the key subject of the document, other items used in conjunction with the rope were addressed as system components.

New criteria for personal escape rope were included to cover a type of life safety rope that is carried by fire fighters/rescuers and used only for fire fighter/rescuer escape or self-rescue in critical entrapment situations where the rope would provide the only viable means

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of escape. There also was new criteria, in addition to the harness requirements, for three types of belts: one intended for use to position a fire fighter on a ladder, a second type for escape/self-rescue using a life safety rope, or a third type for both applications. Definitions were expanded to provide better understanding of terms. The testing requirements were greatly expanded to provide the criteria with which to evaluate the performance and determine pass/fail.

The third edition was acted on by the membership of the Association at the Annual Meeting in Denver, Colorado, on May 24, 1995, and was issued with an effective date of August 11, 1995.

This fourth edition of NFPA 1983 adds a new type of rope — a throwline — a floating rope that is intended to be thrown to a person in water, or used as a tether for rescuers during water rescue incidents. New requirements for pulleys and portable anchors were also added to the fourth edition as new items of system components. The former terminology for one- and two-person load classifications has been changed to a simpler load classification based on the weight that the rope or system is designed to support.

Testing methods for descent control devices were modified to provide more accurate testing for the three types of descenders. Other testing modifications were made throughout Chapter 6 to clarify testing methods and improve reproducibility of testing results.

New requirements for improved product quality assurance through manufacturer's being registered as compliant with ISO, and certification laboratory accreditation have been added. Annual product evaluation, testing, and recertification were also added. All three of these new criteria are directed to raise the bar for product and certification quality and to provide a better level of safety for the end users.

Throughout the document, modifications to existing text were made in the continuing attempt to make the document clearer, less ambiguous, and easier to use by both manufacturers and the certification organizations. This process continues during every revision cycle, and the input received from document users has been very helpful in fixing many of these issues.

This fourth edition was acted on by the Association membership at the Fall Meeting in Orlando, Florida, on November 15, 2000, and was issued with an effective date of February 9, 2001.

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This committee shall also have primary responsibility for documents on station/work uniform garments that are not of themselves primary protective garments but can be combined with a primary protective garment to serve dual or multiple functions.

Additionally, this committee shall have primary responsibility for documents on the selection, care, and maintenance of special operations protective clothing and equipment by fire and emergency services organizations and personnel.

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Standard on

Fire Service Life Safety Rope and System Components

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NOTICE: An asterisk (*) following the number or letter designating a paragraph indicates that explanatory material on the paragraph can be found in Appendix A.

Information on referenced publications can be found in Chapter 7 and Appendix B.

Chapter 1 Administration

1.1 Scope.

1.1.1 This standard shall specify minimum design, performance, testing, and certification requirements for new life safety rope and new system components including escape rope, water rescue throwlines, life safety harness, belts, and auxiliary equipment used for rescue and training by the fire service or similar emergency service organizations.

1.1.2 This standard shall not apply to utility rope. This standard shall not apply to rope and equipment used for special rescue operations including but not limited to mountain rescue, cave rescue, lead climbing operations, or where specific rescue situations dictate other performance requirements. This standard shall not apply to industrial fall situations or recreational uses.

1.1.3 This edition of NFPA 1983 shall not apply to any fire service life safety rope and system components manufactured to previous editions of this standard.

1.1.4* This standard shall not apply to rope or equipment for operations where personnel are required to work above anchor points or in operations where the fall factor might exceed 0.25.

1.1.5 This standard shall not apply to use requirements for fire service life safety rope and system components as these requirements are specified in NFPA 1500, *Standard on Fire Department Occupational Safety and Health Program.*

1.1.6 The requirements of this standard shall not apply to accessories that might be attached to any ensemble or to any element of an ensemble, unless specifically addressed herein.

1.1.7 Nothing herein shall be construed as intended to restrict any jurisdiction or manufacturer from exceeding these minimum requirements.

1.2 Purpose.

1.2.1* The purpose of this standard shall be to establish minimum levels of performance and a reasonable degree of safety for new life safety rope and new system components used to support fire service personnel, or other emergency services personnel, and civilians during rescue, fire-fighting, and other emergency operations, or during training evolutions.

1.2.2 Controlled laboratory tests used to determine compliance with the performance requirements of this standard shall not be deemed as establishing performance for all situations to which this equipment could be exposed.

1.2.3 This standard is not intended to serve as a detailed manufacturing or purchase specification, but shall be permitted to be referenced in purchase specifications as minimum requirements.

1.3 Definitions.

1.3.1 Adjusting Device. An auxiliary equipment system component; a connector device that allows adjustment to be made to a piece of equipment.

1.3.2* Approved. Acceptable to the authority having jurisdiction.

1.3.3 Ascent Device. An auxiliary equipment system component; a friction or mechanical device utilized to allow ascending a fixed line.

1.3.4* Authority Having Jurisdiction. The organization, office, or individual responsible for approving equipment, materials, an installation, or a procedure.

1.3.5 Auxiliary Equipment. System components that are load-bearing accessories designed to be utilized with life safety rope and harness including, but not limited to, ascending devices, carabiners, descent control devices, rope grab devices, and snap-links.

1.3.6 Belt. A system component; material configured as a device that fastens around the waist only and designated as a ladder belt or an escape belt.

1.3.6.1* Escape Belt. A belt that is certified as compliant with the applicable requirements of this standard for an escape belt, and that is intended for use only by the wearer as an emergency self-rescue device.

1.3.6.2 Ladder Belt. A belt that is certified as compliant with the applicable requirements of this standard and is intended for use as a positioning device for a person on a ladder.

1.3.7* Block Creel Construction. Rope constructed without knots or splices in the yarns, ply yarns, strands or braids, or rope.

1.3.8 Buckle. A load-bearing connector that is an integral part of an auxiliary equipment system component and used to connect two pieces of webbing.

1.3.9 Carabiner. An auxiliary equipment system component; an oval or D-shaped metal, load-bearing connector with a self-closing gate used to join other components of a rope system.

1.3.10 Certification/Certified. A system whereby a certification organization determines that a manufacturer has demonstrated the ability to produce a product that complies with the requirements of this standard, authorizes the manufacturer to use a label on listed products that comply with the requirements of this standard, and establishes a follow-up program conducted by the certification organization as a check on the methods the manufacturer uses to determine compliance with the requirements of this standard.

1.3.11 Certification Organization. An independent, third-party organization that determines product compliance with the requirements of this standard with a labeling/listing/follow-up program.

1.3.12 Compliant. Meeting or exceeding all applicable requirements of this standard.

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1.3.13 Continuous Filament Fiber. Fiber of indefinite or unmeasurable length.

1.3.14 Corrosion. A condition exhibiting any signs of deterioration, including pitting or loss of metal.

1.3.15 Descent Control Device. An auxiliary equipment system component; a friction or mechanical device utilized with rope to control descent.

1.3.16* Design Load. The load for which a given piece of equipment or manufactured system was engineered for under normal static conditions.

1.3.17 Diameter (Rope). The length of a straight line through the center of the rope as calculated in 5.1.5, 5.1.6, and 5.2.3 of this standard.

1.3.18 Escape. Immediate self-rescue of a single fire or emergency services person from a life threatening emergency situation, generally above ground, using system components or manufactured systems designed for self-rescue escape.

1.3.19 Escape Belt. See 1.3.6.1, Escape Belt.

1.3.20 Escape Descent Control Device. An auxiliary equipment system component; a friction or mechanical device utilized with escape rope to control descent.

1.3.21 Escape Rope. See 1.3.46, Rope.

1.3.22 Elongation. The increase in length, expressed in a percent of the original gauge length, that occurs in a sample of new rope when tested as specified herein.

1.3.23* Fall Factor. A measure of fall severity calculated by dividing the distance fallen by the length of rope used to arrest the fall. *(See Figure A.1.1.4.)*

1.3.24 Follow-Up Program. The sampling, inspections, tests, or other measures conducted by the certification organization on a periodic basis to determine the continued compliance of labeled and listed products that are being produced by the manufacturer to the requirements of this standard.

1.3.25 General Use. A designation of system components or manufactured systems designed for general-use loads, light-use loads, and escape, and is compliant with this standard.

1.3.26 Hardware. A type of auxiliary equipment that includes but is not limited to ascent devices, carabiners, descent control devices, pulleys, rings, and snap-links.

1.3.27 Harness. See 1.3.31, Life Safety Harness.

1.3.28* Impact Load. Sudden application of a force, which causes kinetic energy and momentum to be converted into other forms of energy.

1.3.29 Labeled. Equipment or materials to which has been attached a label, symbol, or other identifying mark of an organization that is acceptable to the authority having jurisdiction and concerned with product evaluation, that maintains periodic inspection of production of labeled equipment or materials, and by whose labeling the manufacturer indicates compliance with appropriate standards or performance in a specified manner.

1.3.30 Ladder Belt. See 1.3.6, Belt.

1.3.31 Life Safety Harness. A system component; an arrangement of materials secured about the body used to support a person during fire service rescue.

1.3.32 Life Safety Rope. See 1.3.47, Rope.

1.3.33 Light Use. A designation of system components or manufactured systems designed for light-use loads and escape, and is compliant with this standard.

1.3.34 Line. Rope when in use.

1.3.35* Listed. Equipment, materials, or services included in a list published by an organization that is acceptable to the authority having jurisdiction and concerned with evaluation of products or services, that maintains periodic inspection of production of listed equipment or materials or periodic evaluation of services, and whose listing states that either the equipment, material, or service meets appropriate designated standards or has been tested and found suitable for a specified purpose.

1.3.36 Load-Bearing Connector. An auxiliary equipment system component; a device used to join other system components including but not limited to carabiners, rings, rapid links, and snap-links.

1.3.37 Manufactured System. Preassembled system, sold as a unit by the manufacturer and tested as a complete assembly.

1.3.38 Manufacturer. The entity that assumes the liability and provides the warranty for the compliant product.

1.3.39 Manufacturer's Lot. An identifiable series of products that can be the same as or a subset of a production lot; used by the manufacturer for quality control or identification purposes.

1.3.40 Melt. A response to heat by a material resulting in evidence of flowing or dripping.

1.3.41 Minimum Breaking Strength (MBS). The result of subtracting three standard deviations from the mean result of the lot being tested using the formulas in 6.1.1.2 and 6.2.1.2.

1.3.42* Portable Anchor. A manufactured device designed to support human loads.

1.3.43* Product Label. A label affixed to the product by the manufacturer containing general information, care, maintenance, or similar data.

1.3.44 Production Lot. An identifiable series of products manufactured with identical design specifications and identical materials, and produced without any alterations to technique or procedure.

1.3.45* Proof Load. The application of force to a material as a nondestructive test to verify the performance of that material.

1.3.46 Ring. An auxiliary equipment system component; an ungated load-bearing connector.

1.3.47 Rope. A compact but flexible, torsionally balanced, continuous structure of fibers produced from strands that are twisted, plaited, or braided together, and that serve primarily to support a load or transmit a force from the point of origin to the point of application.

1.3.47.1 Escape Rope. A system component; a single-purpose, *one-time use*, emergency self-escape (self-rescue) rope; not classified as a life safety rope.

1.3.47.2 Life Safety Rope. Rope dedicated solely for the purpose of supporting people during rescue, fire-fighting, other emergency operations, or during training evolutions.

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1.3.48 Rope Grab Device. An auxiliary equipment system component; a device used to grasp a life safety rope for the purpose of supporting loads; can be used in ascending a fixed line.

1.3.49 Sample. A specified number of life safety ropes or a specified number of system components taken from a manufacturer's current production lot.

1.3.50 Self-Destructive Action. Interaction of materials in a manner that leads to deterioration.

1.3.51 Shall. Indicates a mandatory requirement.

1.3.52 Should. Indicates a recommendation or that which is advised but not required.

1.3.53 Snap-Link. An auxiliary equipment system component; a self-closing, gated, load-bearing connector.

1.3.54 Software. A type of auxiliary equipment that includes but is not limited to anchor straps, pick-off straps, and rigging slings.

1.3.55* Standard Deviation. A parameter that indicates the way in which a probability function is centered around its mean.

1.3.56 System Components. Life safety harness, belts, and auxiliary equipment devices.

1.3.57 Test Lanyard. Static kernmantle rope used to connect the test mass to anchorage in dynamic drop tests.

1.3.58 Throwline. A floating, one-person rope that is intended to be thrown to a person during water rescues or as a tether for rescuers entering the water.

1.3.59 Virgin Fiber. Fiber that is new and previously unused.

1.3.60 Waist. For the purpose of this document, waist refers to the area above the hips and below the xiphoid process.

1.3.61 Webbing. Woven material in the form of a long strip; can be of flat or tubular weave.

1.4 Units.

1.4.1 In this standard, values for measurement are followed by an equivalent in parentheses, but only the first stated value shall be regarded as the requirement.

1.4.2 Equivalent values in parentheses shall not be considered as the requirement, as these values might be approximate.

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Chapter 2 Certification

2.1 General.

2.1.1 All individual items of fire service life safety rope and system components that are labeled as being compliant with this standard shall meet or exceed all applicable requirements specified in this standard and shall be certified. Manufacturers shall not claim compliance with a portion(s) or segment(s) of the requirements of this standard and shall not use the name or identification of this standard, NFPA 1983, in any statements about their respective products unless the product is certified to this standard.

2.1.2 All certification shall be performed by a certification organization that meets at least the requirements specified in Section 2.2, and that is accredited for personal protective equipment in accordance with ISO Guide 65, *General requirements for bodies operating product certification systems.*

2.1.3 All individual items of fire service life safety rope and system components shall be labeled and listed. All individual items of fire service life safety rope and system components shall also have a product label. The product label shall meet the requirements specified in Section 3.1.

2.1.4 The certification organization's label, symbol, or identifying mark shall be attached to the product label or shall be part of the product label.

2.1.5 The certification organization shall not certify any items of fire service life safety rope and system components to the 1995 edition of NFPA 1983 on or after 1 September 2001.

2.1.6 The certification organization shall not permit any manufacturer to label any items of fire service life safety rope and system components as compliant with the 1995 edition of NFPA 1983 on or after 1 September 2001.

2.1.7 The certification organization shall require manufacturers to remove all certification labels and product labels indicating compliance with the 1995 edition or earlier editions of NFPA 1983 from all items of fire service life safety rope and system components that are under the control of the manufacturer on 1 September 2001. The certification organization shall verify this action is taken.

2.2 Certification Program.

2.2.1* The certification organization shall not be owned or controlled by manufacturers or vendors of the product being certified. The certification organization shall be primarily engaged in certification work and shall not have a monetary interest in the product's ultimate profitability.

2.2.2 The certification organization shall refuse to certify products to this standard that do not comply with all requirements of this standard.

2.2.3* The contractual provisions between the certification organization and the manufacturer shall specify that certification is contingent on compliance with all applicable requirements of this standard. There shall be no conditional, temporary, or partial certifications. Manufacturers shall not be authorized to use any label or reference to the certification organization on products that are not manufactured in compliance with all applicable requirements of this standard.

2.2.4* The certification laboratory shall have laboratory facilities and equipment for conducting proper tests, a program for calibration of all instruments shall be in place and operating, and procedures shall be in use to ensure proper control of all testing. Good practice shall be followed regarding the use of laboratory manuals, form data sheets, documented calibration and calibration routines, performance verification, proficiency testing, and staff qualification and training programs.

2.2.5 The certification organization shall require the manufacturer to establish and maintain a program of production inspection and testing that at least meets the requirements of Section 2.4. The certification organization shall ensure that the audit assurance program provides continued product compliance with this standard.

2.2.6 The certification organization and the manufacturer shall evaluate any changes affecting the form, fit, or function of the certified product to determine its continual certification of this standard.

2.2.7* The certification organization shall have a follow-up inspection program of the manufacturing facilities of the certified product, with at least two random and unannounced visits per 12-month period. As part of the follow-up inspection program, the certification organization shall select sample product at random from the manufacturer's production line, from the manufacturer's in-house stock, or from the open market. The certification organization shall have a statistically validated process for determining the critical inspections and tests to be conducted through this follow-up program to verify the continued compliance of the product or component.

2.2.8 The certification organization shall have a program for investigating field reports alleging malperformance or failure of listed products.

2.2.9 The certification organization shall require the manufacturer to have a product recall system as part of the manufacturer's quality assurance program.

2.2.10 The operating procedures of the certification organization shall provide a mechanism for the manufacturer to appeal decisions. The procedures shall include the presentation of information from both sides of a controversy to a designated appeals panel.

2.2.11 The certification organization shall be in a position to use legal means to protect the integrity of its name and label. The name and label shall be registered and legally defended.

2.3 Inspection and Testing.

2.3.1 For both initial certification and recertification of fire service life safety rope and system components, the certification organization shall conduct both inspection and testing as specified in this section.

2.3.2 All inspections, evaluations, conditioning, and testing for certification or for recertification shall be conducted by the certification organization or a facility accredited by the certification organization for inspections, evaluations, conditioning, and testing in accordance with all requirements pertaining to testing laboratories in ISO/IEC 17025, *General requirements for the competence of testing and calibration laboratories.*

2.3.3 All inspections, evaluations, conditioning, or testing conducted by a product manufacturer shall not be used in the certification or recertification process unless the facility for inspections, evaluations, conditioning, or testing has been accredited by the certification organization in accordance with all requirements pertaining to testing laboratories in ISO/IEC 17025 *General requirements for the competence of testing and calibration laboratories.*

2.3.4 Sampling levels for testing and inspection shall be established by the certification organization and the manufacturer to assure a reasonable and acceptable reliability at a reasonable and acceptable confidence level that products certified to this standard are compliant unless such samples levels are specified herein.

2.3.5 Inspection by the certification organization shall include a review of all product labels to ensure that all required label attachment, compliance statements, other statements, and other product information are at least as specified for the specific item in Section 3.1.

2.3.6 Inspection by the certification organization shall include a review of any graphic representations used on product labels, as permitted by 3.1.1.7, to ensure that the graphics are consistent with the worded statements, readily understood, and clearly communicate the intended message.

2.3.7 Inspection by the certification organization shall include a review of the user information required by Section 3.2 to ensure that the information has been developed and is available.

2.3.8 Inspection by the certification organization for determining compliance with the design requirements specified in Chapter 4 shall be performed on whole or complete products.

2.3.9 Testing to determine product compliance with the requirements specified in Chapter 5 shall be conducted by the certification organization in accordance with the testing requirements of Chapter 6. Testing shall be performed on samples representative of materials and components used in the actual construction of fire service life safety rope and system components. The certification organization shall also be permitted to use sample materials cut from a representative product. The certification organization shall not allow test specimens that have been conditioned and tested for one test method to be reconditioned and tested for another test method unless specifically permitted in the test method.

2.3.10 Any change in the design, construction, or material of a compliant product shall necessitate new inspection and testing to verify compliance to all applicable requirements of this standard that the certification organization determines can be affected by such change. This recertification shall be conducted before labeling the modified products as being compliant with this standard.

2.3.11 The certification organization shall not allow any modifications, pretreatment, conditioning, or other such special processes of the product or any product component prior to the product's submission for evaluation and testing by the certification organization. The certification organization shall accept, from the manufacturer for evaluation and testing for certification, only product or product components that are the same in every respect to the actual final product or product component. The certification organization shall not allow the substitution, repair, or modification, other than as specifically permitted herein, of any product or any product component during testing.

2.3.12 The manufacturer shall maintain all design and performance inspection and test data from the certification organization used in the certification of the manufacturer's compliant product. The manufacturer shall provide such data, upon request, to the purchaser or authority having jurisdiction.

2.4 Recertification.

2.4.1 All fire service life safety rope and system component models that are labeled as being compliant with this standard shall undergo recertification on an annual basis. This recertification shall include inspection and evaluation to all design requirements and testing to all performance requirements as required by this standard on all manufacturers' models and components as required by 2.4.3.

2.4.1.1 Any change that affects the life safety rope or system component performance under design or performance requirements of this standard shall constitute a different model.

2.4.1.2 For the purpose of this standard, models shall include each unique pattern, style, or design of life safety rope or system component.

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2.4.2 Samples of manufacturers' models and components for recertification shall be acquired from the manufacturer or component supplier during random and unannounced visits as part of the follow-up program. For recertification, the certification organization shall acquire at least one complete life safety rope or system component sample. The certification organization shall also acquire a sufficient quantity of component samples to be tested for recertification as required by 2.4.3.

2.4.3 One sample of each life safety rope and system component shall be inspected and evaluated to each of the design requirements specified in the applicable sections of Chapter 4.

2.4.4 One sample of each life safety rope and system component shall be tested for overall performance as specified in the applicable sections of Chapter 5.

2.4.5 The manufacturer shall maintain all design, inspection, performance, and test data from the certification organization produced during the recertification of manufacturer's models and components. The manufacturer shall provide such data, upon request, to the purchaser or to the authority having jurisdiction.

2.5 Manufacturer's Quality Assurance Program.

2.5.1 The manufacturer shall provide and maintain a quality assurance program that includes a documented inspection and product recall system. The manufacturer shall have an inspection system to substantiate conformance to this standard.

2.5.2 The manufacturer shall maintain written inspection and testing instructions. The instructions shall prescribe inspection and test of materials, work in process, and completed articles. Criteria for acceptance and rejection of materials, processes, and final product shall be part of the instructions.

2.5.3 The manufacturer shall maintain records of all pass/fail tests. Pass/fail records shall indicate the disposition of the failed material or product.

2.5.4 The manufacturer's inspection system shall provide for procedures that assure the latest applicable drawings, specifications, and instructions are used for fabrication, inspection, and testing.

2.5.5 The manufacturer shall, as part of the quality assurance program, maintain a calibration program of all instruments used to ensure proper control of testing. The calibration program shall be documented as to the date of calibration and performance verification.

2.5.6 The manufacturer shall maintain a system for identifying the appropriate inspection status of component materials, work in process, and finished goods.

2.5.7 The manufacturer shall establish and maintain a system for controlling nonconforming material, including procedures for the identification, segregation, and disposition of rejected material. All nonconforming materials or products shall be identified to prevent use, shipment, and intermingling with conforming materials or products.

2.5.8 The manufacturer's quality assurance program shall be audited by the third-party certification organization to determine that the program is sufficient to ensure continued product compliance with this standard.

2.5.9 The manufacturer's quality assurance program shall describe how the quality assurance method used to ensure that each item of production complies with the requirements of Chapters 4 and 5 of this standard.

2.6 ISO Registration for Manufacturers.

2.6.1 The manufacturer shall provide and operate a quality assurance program that meets the requirements of this section and that includes a product recall system as specified in 2.2.9.

2.6.2 The manufacturer shall be registered to ISO 9001, *Quality management systems — Requirements.*

2.6.3 The ISO registration requirements shall have an effective date of 1 March 2003.

2.6.4 Until 1 March 2003, or until the date the manufacturer becomes ISO registered, whichever date occurs first, the manufacturer shall comply with Section 2.5.

Chapter 3 Labeling and Information

3.1 Product Labeling Requirements.

3.1.1* General.

3.1.1.1 Each fire service life safety rope and system component shall have a product label.

3.1.1.1.1 Product labels shall be permanently and conspicuously attached to, embossed on, or printed on each item, other than as permitted by 3.1.1.1.2 and 3.1.1.1.3, when the item is properly assembled with all components in place.

3.1.1.1.2 For auxiliary equipment, the product label shall be permitted to be a hang tag affixed to each piece of auxiliary equipment or shall be permitted to be printed on a sheet that is inserted and sealed in the packaging that immediately contains the piece of auxiliary equipment.

3.1.1.1.3 For load-bearing software auxiliary equipment, the product label shall be permitted to be sewn, stapled, riveted, or otherwise permanently affixed.

3.1.1.2 Multiple label pieces shall be permitted in order to carry all statements and information required to be on the product label; however, all label pieces comprising the entire product label shall be located adjacent to each other.

3.1.1.3 All worded portions of the required product label shall at least be in English.

3.1.1.4 Symbols and other pictorial graphic representations shall be permitted to be used to supplement worded statements on the product label(s).

3.1.1.5 The certification organization's label, symbol, or identifying mark shall be legibly printed on the product label. All letters shall be at least 2.5 mm ($^3/_{32}$ in.) high.

3.1.1.6 The compliance and information statements specified in 3.1.2, 3.1.3, 3.1.4, 3.1.5, 3.1.6, and 3.1.7, as applicable for the specific life safety rope or system component, shall be legibly printed on the product label. All letters shall be at least 1.6 mm ($^1/_{16}$ in.) high.

3.1.1.7 In addition to the compliance and information statements in 3.1.1.6, at least the following information shall also be printed legibly on the product label(s):

(1) Manufacturer's name, identification, or designation
(2) Manufacturer's address
(3) Country of manufacture

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(4) Manufacturer's product identification
(5) Model, style, lot, or serial number

All letters shall be at least 1.6 mm ($^1/_{16}$ in.) high.

3.1.1.8 Where detachable components must be used with a life safety rope or system component in order for the life safety rope or system component to be compliant with this standard, at least the following statement and information shall also be printed legibly on the product label of the life safety rope or system component that requires the additional components. All letters shall be at least 2.5 mm ($^3/_{32}$ in.) high. The appropriate term for the rope or system component shall be inserted where indicated in the label text. The detachable component(s) shall be listed, following this statement, by type, identification, and how properly used.

"TO BE COMPLIANT WITH **NFPA 1983**, THE
FOLLOWING ADDITIONAL COMPONENTS
MUST BE USED IN CONJUNCTION WITH THIS
(insert the term for the type of rope or other system component here):"

[The detachable component(s) shall be listed here.]

3.1.1.9 Where rope and auxiliary equipment are integral and nonseparable pieces of a manufactured system and that system is certified as compliant with this standard, such integral and nonseparable components shall not be required to be individually labeled. Harnesses and belts used in manufactured systems shall be required to be individually labeled.

3.1.1.10 Load-bearing hardware auxiliary equipment shall be stamped, engraved, or otherwise permanently marked with the required product label information in 3.1.1.5, 3.1.6.1, 3.1.6.2, and 3.1.6.3.

3.1.2 Life Safety Rope Compliance and Information Statements.

3.1.2.1* Each life safety rope shall have the following compliance statement on the product label.

"THIS ROPE MEETS THE LIFE SAFETY ROPE
REQUIREMENTS OF NFPA 1983, STANDARD ON
FIRE SERVICE LIFE SAFETY ROPE AND SYSTEM
COMPONENTS, 2001 EDITION.

CLASS: ______________ -USE ROPE"

3.1.2.2 In addition to the compliance statement specified in 3.1.2.1, at least the following information shall be provided on the product label.

"MINIMUM BREAKING STRENGTH: ____________ k/N
DIAMETER: ____________ mm"

Type of fiber(s)

3.1.2.3 In addition to the product label specified in 3.1.1 and 3.1.2.1, each life safety rope shall be marked for its full length by insertion of a continuous identification tape. At least the following statement and information shall be legibly printed on the tape not less than once every meter (39 in.).

"MEETS REQUIREMENTS FOR LIFE SAFETY ROPE
OF NFPA 1983"

Certification organization's label, symbol, or identifying mark

Name of manufacturer

Year and quarter of manufacture (not coded)

3.1.2.4 The class designation of the life safety rope required to be stated on the product label shall be as determined by the certification organization in accordance with Section 5.1.

3.1.2.5 The minimum breaking strength of the life safety rope required to be stated on the product label shall be as determined by the certification organization in accordance with 5.1.1 or 5.1.2, as applicable.

3.1.2.6 The diameter of the life safety rope required to be stated on the product label shall be as determined by the certification organization in accordance with 5.1.5.

3.1.2.7 Any life safety rope that is designed to include components with electric-current carrying capabilities shall also meet labeling requirements of Class I, Division 1, hazardous locations specified in ANSI/UL 913, *Standard for Intrinsically Safe Apparatus and Associated Apparatus for Use in Class I, II, and III, Division 1, Hazardous (Classified) Locations.*

3.1.3 Escape Rope Compliance and Information Statements.

3.1.3.1* Each escape rope shall have the following compliance statement on the product label.

"THIS ROPE MEETS THE ESCAPE ROPE
REQUIREMENTS OF NFPA 1983, STANDARD
ON FIRE SERVICE LIFE SAFETY ROPE AND
SYSTEM COMPONENTS, 2001 EDITION."

3.1.3.2 In addition to the compliance statement specified in 3.1.3.1, at least the following information shall be provided on the product label.

"MINIMUM BREAKING STRENGTH: ___________ k/N
DIAMETER: ___________ mm"
Type of fiber(s)

3.1.3.3* In addition to the product label specified in 3.1.1 and 3.1.3.1, each escape rope shall be marked for its full length by insertion of a continuous identification tape. At least the following statement and information shall be legibly printed on the tape not less than once every meter (39 in.).

"MEETS REQUIREMENTS FOR ESCAPE ROPE
OF NFPA 1983"

Certification organization's label, symbol, or identifying mark

Name of manufacturer

Year and quarter of manufacture

3.1.3.4 The minimum breaking strength of the escape rope required to be stated on the product label shall be as determined by the certification organization in accordance with 5.2.1.

3.1.3.5 The diameter of the escape rope required to be stated on the product label shall be as determined by the certification organization in accordance with 5.2.3.

3.1.4 Life Safety Harness Compliance and Information Statements.

3.1.4.1 Each life safety harness shall have at least the following compliance statement on the product label.

"THIS LIFE SAFETY HARNESS MEETS THE
HARNESS REQUIREMENTS OF NFPA 1983,
STANDARD ON FIRE SERVICE LIFE SAFETY
ROPE AND SYSTEM COMPONENTS,
2001 EDITION; CLASS ___________."

3.1.4.2* In addition to the compliance statement specified in 3.1.4.1, at least the following information shall be provided on the product label.

(1) For Class I and II harness:

"Fits waist size __________ "

(2) For one-piece Class III harness:

"Fits waist size __________
Fits height __________ "
or
"Fits chest size __________
Fits height __________ "

(3) For multiple-piece Class III harness:

"Fits waist size __________
Fits height __________ "
or
"Fits chest size __________
Fits height __________
This is one part of a multiple-piece harness and must be used in conjunction with component part number _____ in order to fully meet the criteria of Class III harness."

3.1.4.3 The class designation of the life safety harness required to be stated on the product label(s) shall be as determined by the certification organization in accordance with 4.3.1.

3.1.5 Belt Compliance and Information Statements.

3.1.5.1 Each belt shall have the following compliance statement on the product label.

"THIS BELT MEETS THE BELT REQUIREMENTS
OF NFPA 1983, STANDARD ON FIRE SERVICE
LIFE SAFETY ROPE AND SYSTEM COMPONENTS,
2001 EDITION; TYPE __________."

3.1.5.2 In addition to the compliance statement specified in 3.1.5.1, at least the following information shall be provided on the product label.

"Fits waist size __________ "

3.1.5.3 The type designation of belt required to be stated on the product label(s) shall be as determined by the certification organization in accordance with 4.4.1.

3.1.6 Auxiliary Equipment Compliance and Information Statements.

3.1.6.1 Each item of auxiliary equipment shall have the following compliance statement on the product label.

"MEETS NFPA 1983 (2001 ED.)"

3.1.6.2 In addition to the compliance statement specified in 3.1.6.1, at least the minimum rated breaking strength prefaced by the letters MBS shall be provided on the product label.

3.1.6.3 In addition to the compliance statement specified in 3.1.6.1, auxiliary equipment shall also be stamped, engraved, or otherwise permanently marked with a "G" for general use, an "L" for light use, or an "E" for escape use as designated in accordance with Section 5.5 and Section 5.6 as applicable.

3.1.6.4 In addition to the compliance statement specified in 3.1.6.1, portable anchor auxiliary equipment devices shall include the following additional information on the product label.

"MINIMUM BREAKING STRENGTH AND RATING
ARE DETERMINED AT THE CONFIGURATION
OF LOWEST STRENGTH PER
MANUFACTURER'S INSTRUCTIONS."

3.1.7 Throwline Compliance and Information Statements.

3.1.7.1* Each throwline shall have the following compliance statement on the product label.

"THIS ROPE MEETS THE THROWLINE
REQUIREMENTS OF NFPA 1983, STANDARD
ON FIRE SERVICE LIFE SAFETY ROPE AND
SYSTEM COMPONENTS, 2001 EDITION."

3.1.7.2 In addition to the compliance statement specified in 3.1.7.1, at least the following information shall be provided on the product label.

"MINIMUM BREAKING STRENGTH: __________ k/N

DIAMETER: __________ mm"

Type of fiber(s)

3.1.7.3 In addition to the product label specified in 3.1.1 and 3.1.7.1, each throwline shall be marked for its full length by insertion of a continuous identification tape. At least the following statement and information shall be legibly printed on the tape not less than once every meter (39 in.).

"MEETS REQUIREMENTS FOR THROWLINE

OF NFPA 1983"

Year and quarter of manufacture

3.1.7.4 The minimum breaking strength of the throwline required to be stated on the product label shall be as determined by the certification organization in accordance with 5.7.1.

3.1.7.5 The diameter of the throwline required to be stated on the product label shall be as determined by the certification organization in accordance with 5.7.2.

3.2 User Information.

3.2.1* Life Safety Rope User Information.

3.2.1.1 The manufacturer of life safety rope that is certified as being compliant with this standard shall furnish the purchaser with at least use criteria, inspection procedures, maintenance procedures, and retirement criteria for the product.

3.2.1.2 The manufacturer shall provide information for the user to consider prior to reusing life safety rope, including that the rope be considered for reuse only if at least all of the following conditions are met:

(a) Rope has not been visually damaged.

(b) Rope has not been exposed to heat, direct flame impingement, or abrasion.

(c) Rope has not been subjected to any impact load.

(d) Rope has not been exposed to liquids, solids, gases, mists, or vapors of any chemical or other material that can deteriorate rope.

(e) Rope passes inspection when inspected by a qualified person following the manufacturer's inspection procedures both before and after each use.

The manufacturer shall provide information for the user regarding not using the life safety rope and removing the rope from service if the rope does not meet all of the conditions in

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3.2.1.2, if the rope does not pass inspection, or if there is any doubt about the safety or serviceability of the rope.

3.2.1.3 The manufacturer shall provide information for the user regarding at least the following issues:

(1)* Inspecting the rope periodically according to the manufacturer's inspection procedure
(2) Removing the rope from service and destroying it if the rope does not pass inspection or if there is any doubt about the safety or serviceability of the rope
(3) Protecting the rope from abrasion
(4) Not exposing the rope to flame or high temperature and carrying the rope where it will be protected as the rope could melt or burn and fail if exposed to flame or high temperature
(5) Keeping the product label and user instructions/information after they are removed/separated from the rope and retaining them in the permanent rope record; copying the product label and user instructions/information and keeping the copies with the rope
(6) Referring to the user instructions/information before and after each use
(7) Cautioning that, if the instructions/information are not followed, what serious consequences could occur to the user

3.2.1.4 The manufacturer shall provide information for the user that additional information regarding life safety rope can be found in NFPA 1500, *Standard on Fire Department Occupational Safety and Health Program*, and NFPA 1983, *Standard on Fire Service Life Safety Rope and System Components.*

3.2.1.5 The manufacturer of life safety rope that is certified as being compliant with this standard shall furnish the purchaser with a sample of suggested records to be maintained by the purchaser or user of life safety rope and a list of items that the records need to contain.

3.2.2 Escape Rope User Information.

3.2.2.1 The manufacturer of escape rope that is certified as being compliant with this standard shall furnish the purchaser with at least use criteria, inspection procedures, maintenance procedures, and retirement criteria for the product.

3.2.2.2 The manufacturer shall provide information for the user regarding at least the following issues:

(1) Using the rope only with a life safety harness or escape belt
(2) Inspecting the rope periodically according to the manufacturers' inspection procedure
(3)* Removing the rope from service and destroying it if the rope does not pass inspection or if there is any doubt about the safety or serviceability of the rope
(4) Protecting the rope from abrasion
(5) Not exposing the rope to flame or high temperature and carrying the rope where it will be protected as the rope could melt or burn and fail if exposed to flame or high temperature
(6) Keeping the product label and user instructions/information after they are removed/separated from the rope for future reference
(7) Referring to the user instructions/information before and after each use
(8) Cautioning that, if the instructions/information are not followed, what serious consequences could occur to the user

3.2.2.3 The manufacturer shall provide information for the user that additional information regarding escape rope can be found in NFPA 1500, *Standard on Fire Department Occupational Safety and Health Program*, and NFPA 1983, *Standard on Fire Service Life Safety Rope and System Components.*

3.2.2.4 The manufacturer of escape rope that is certified as being compliant with this standard shall furnish the purchaser with a sample of suggested records to be maintained by the purchaser, or user of escape rope, and a list of items that the records need to contain.

3.2.3 Life Safety Harness User Information.

3.2.3.1 The manufacturer of life safety harness that is certified as being compliant with this standard shall furnish the purchaser with at least use criteria, inspection procedures, maintenance procedures, and retirement criteria for the product.

3.2.3.2 The manufacturer shall provide information for the user regarding at least the following issues:

(1) Inspecting the harness periodically according to the manufacturer's inspection procedure
(2) Removing the harness from service and destroying it if the harness does not pass inspection or if there is any doubt about the safety or serviceability of the harness
(3) Not exposing the harness to flame or high temperature and carrying the harness where it will be protected as the harness could melt or burn and fail if exposed to flame or high temperature
(4) Repairing the harness only in accordance with the manufacturer's instructions
(5) Keeping the user instructions/information after it is separated from the harness and retaining it in a permanent record; copying the user instructions/information and keeping the copy with the harness
(6) Referring to the user instructions/information before and after each use
(7) Cautioning that, if the instructions/information are not followed, what serious consequences could occur to the user

3.2.3.3 The manufacturer shall provide information for the user that additional information regarding life safety harness can be found in NFPA 1500, *Standard on Fire Department Occupational Safety and Health Program*, and NFPA 1983, *Standard on Fire Service Life Safety Rope and System Components.*

3.2.3.4 The manufacturer of life safety harness that is certified as being compliant with this standard shall furnish the purchaser with a sample of suggested records to be maintained by the purchaser or user of life safety harness and a list of items that the records need to contain.

3.2.4 Belt User Information.

3.2.4.1 The manufacturer of belts that are certified as being compliant with this standard shall furnish the purchaser with at least use criteria, inspection procedures, maintenance procedures, and retirement criteria for the product.

3.2.4.2 The manufacturer shall provide information for the user regarding at least the following issues:

(1) Inspecting the belt periodically according to the manufacturer's inspection procedure
(2) Removing the belt from service and destroying it if the belt does not pass inspection or if there is any doubt about the safety or serviceability of the belt
(3) Not exposing the belt to flame or high temperature and carrying the belt where it will be protected as the

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belt could melt or burn and fail if exposed to flame or high temperature
(4) Repairing the belt only in accordance with the manufacturer's instructions
(5) Keeping the user instructions/information after it is separated from the belt and retaining it in a permanent record; copying the user instructions/information and keeping the copy with the belt
(6) Referring to the user instructions/information before and after each use
(7) Cautioning that, if the instructions/information are not followed, what serious consequences could occur to the user

3.2.4.3 The manufacturer shall provide information for the user that additional information regarding belts can be found in NFPA 1500, *Standard on Fire Department Occupational Safety and Health Program*, and NFPA 1983, *Standard on Fire Service Life Safety Rope and System Components*.

3.2.4.4 The manufacturer of belts that are certified as being compliant with this standard shall furnish the purchaser with a sample of suggested records to be maintained by the purchaser or user of belts and a list of items that the records need to contain.

3.2.5 Auxiliary Equipment User Information.

3.2.5.1 The manufacturer of auxiliary equipment that is certified as being compliant with this standard shall furnish the purchaser with at least use criteria, inspection procedures, maintenance procedures, and retirement criteria for the product.

3.2.5.2 The manufacturer shall provide information for the user regarding at least the following issues:

(1) Inspecting the auxiliary equipment periodically according to the manufacturer's inspection procedure
(2) Removing the auxiliary equipment from service if the equipment does not pass inspection or if there is any doubt about the safety or serviceability of the equipment
(3) Maintaining the auxiliary equipment in accordance with the manufacturer's instructions when metal components are subjected to corrosion or deterioration
(4) Returning auxiliary equipment to the manufacturer or to a qualified inspection person/center if the equipment is dropped or impact loaded
(5) Not exposing the software auxiliary equipment to flame or high temperature and carrying the equipment where it will be protected as it could melt or burn and fail if exposed to flame or high temperature
(6) Repairing the auxiliary equipment only in accordance with the manufacturer's instructions
(7) Keeping the user instructions/information after it is separated from the auxiliary equipment and retaining it in a permanent record; copying the user instructions/information and keeping the copy with the equipment
(8) Referring to the user instructions/information before and after each use
(9) Cautioning that, if the instructions/information are not followed, what serious consequences could occur to the user

FAIR USE

3.2.5.3 The manufacturer shall provide information for the user that additional information regarding auxiliary equipment can be found in NFPA 1500, *Standard on Fire Department Occupational Safety and Health Program*, and NFPA 1983, *Standard on Fire Service Life Safety Rope and System Components*.

3.2.5.4 The manufacturer of auxiliary equipment that is certified as being compliant with this standard shall furnish the purchaser with a sample of suggested records to be maintained by the purchaser or user of the auxiliary equipment and a list of items that the records need to contain.

3.2.5.5* In addition to the requirements for auxiliary equipment, the manufacturer of portable anchors shall provide information for the user that indicates the minimum breaking strength at the highest level of adjustment or at the maximum leg extension for which the device is designed to support human loads. This information shall be provided for each attachment point, if they differ, to which human loads may be attached.

3.2.5.6 The manufacturer of manufactured systems auxiliary equipment that are certified as being compliant with this standard shall furnish the purchaser with a sample of suggested records to be maintained by the purchaser or user of the manufactured system auxiliary equipment.

Chapter 4 Design and Construction Requirements

4.1 Life Safety Rope.

4.1.1* Life safety rope shall be constructed of virgin fiber.

4.1.2 Life safety rope shall be of block creel construction; primary load-bearing elements shall be constructed of continuous filament fiber.

4.1.3 Life safety rope that is designed to include components with electric current–carrying capabilities shall meet the requirements for Class I, Division 1, hazardous locations of ANSI/UL 913, *Standard for Intrinsically Safe Apparatus and Associated Apparatus for Use in Class I, II, and III, Division 1, Hazardous (Classified) Locations.*

4.2 Escape Rope System Component.

4.2.1* Escape rope shall be constructed of virgin fiber.

4.2.2 Escape rope shall be of block creel construction; primary load-bearing elements shall be constructed of continuous filament fiber.

4.3 Life Safety Harness System Component.

4.3.1 Life safety harness shall be designed and designated in accordance with one of the following classes.

4.3.1.1 Harness that fastens around waist and around thighs or under buttocks and designed to be used for emergency escape with a design load of 1.33 k/N (300 lbf) shall be designated as Class I life safety harness.

4.3.1.2 Harness that fastens around waist and around thighs or under buttocks and designed for rescue with a design load of 2.67 k/N (600 lbf) shall be designated as Class II life safety harness.

4.3.1.3 Harness that fastens around waist, around thighs, or under buttocks, and over shoulders, and designed for rescue with a design load of 2.67 k/N (600 lbf) shall be designated as Class III life safety harness. Class III life safety harness shall be permitted to consist of one or more parts.

4.3.2* Life safety harness shall be permitted to be adjustable within a range of sizes, provided in a range of sizes, or custom-fitted for individuals.

4.3.3* Load-bearing textile materials used in the construction of life safety harness shall be made from virgin, synthetic, continuous filament fiber.

4.3.4* All webbing ends shall be secured by heat sealing or by another method that prevents unraveling.

4.3.5* All thread utilized in the construction of life safety harness shall be compatible with the webbing used and shall allow for ease of inspection by the unaided eye with 20/20 vision, or vision corrected to 20/20, at a nominal distance of 305 mm (12 in.). All stitching breaks or ends shall be backtacked not less than 13 mm ($^1/_2$ in.).

4.3.6 Life safety harness shall have at least one load-bearing attachment point located at the front waist or sternal location of the harness.

4.4 Belt System Component.

4.4.1 Belts shall be designed and designated in accordance with one of the types in 4.4.1.1 or 4.4.1.2.

4.4.1.1 A belt that fastens only around the waist and is intended for use as a positioning device for a person on a ladder shall be designated as a *ladder belt.*

4.4.1.2 A belt that fastens only around the waist and is intended for use by the wearer as an emergency self-rescue device shall be designated as an *escape belt.*

4.4.2* All belts shall be permitted to be adjustable within a range of sizes, provided in a range of sizes, or custom-fitted for individuals.

4.4.3* Load-bearing textile materials used in the construction of all belts shall be made from virgin, synthetic, continuous filament fiber.

4.4.4* All belts shall have webbing ends secured by heat sealing or by another method that prevents unraveling.

4.4.5* All thread utilized in the construction of all belts shall be compatible with the webbing used and shall allow for ease of inspection by the unaided eye with 20/20 vision, or vision corrected to 20/20, at a nominal distance of 305 mm (12 in.). All stitching breaks or ends shall be backtacked not less than 13 mm ($^1/_2$ in.).

4.4.6 The ladder belt tether or device that connects the wearer to a ladder shall be permanently affixed to the ladder belt and shall not be greater than 450 mm ($17^3/_4$ in.) in length.

FAIR USE

4.5 Auxiliary Equipment System Component.

4.5.1 Auxiliary equipment shall not be designed or constructed in a manner that allows self-destructive action.

4.5.2 Auxiliary equipment shall be designated by the manufacturer for its intended use and design load as either escape, light use, or general use.

4.5.2.1 The designation of escape shall apply to auxiliary equipment intended for the sole use of the rescuer for personal escape or self-rescue.

4.5.2.2* The designation of light use shall apply to auxiliary equipment intended for a design load of 1.33 k/N (300 lbf).

4.5.2.3* The designation of general use shall apply to auxiliary equipment intended for design loads of 2.67 k/N (600 lbf).

4.5.3 Load-bearing hardware auxiliary equipment shall be constructed of forged, machined, stamped, extruded, or cast metal. Castings shall meet Class I, Grade A requirements of MIL-STD 2175A, *Castings, Classification and Inspection of.*

4.5.4 Where a buckle is an integral part of an auxiliary equipment system component, the buckles shall have a corner radius of not less than 6 mm ($^1/_4$ in.).

4.5.5 Where a buckle is an integral part of an auxiliary equipment system component, the buckle manufacturer shall provide written evidence that all load-bearing buckles have been proof-loaded to at least 11 k/N (2473 lbf).

4.5.6* Snap-link and carabiner gates shall be self-closing and of a locking design.

4.5.7 Webbing used to construct auxiliary equipment software shall be constructed of virgin, synthetic, continuous filament fiber.

4.5.8 All webbing ends used to construct auxiliary equipment software shall be secured by heat sealing or by another method that prevents unraveling.

4.5.9* All thread utilized to construct auxiliary equipment software shall be compatible with webbing used and shall allow for ease of inspection by the unaided eye with 20/20 vision, or vision corrected to 20/20, at a nominal distance of 305 mm (12 in.). All stitching breaks or ends shall be backtacked not less than 13 mm ($^1/_2$ in.).

4.5.10 Rope grab devices shall be designated as being designed for use as component parts of personal ascent systems or as grabbing devices for use in rescue systems.

4.6 Throwline.

4.6.1 Throwline shall be constructed of virgin fiber.

4.6.2 Throwline shall be of block creel construction; load-bearing elements shall be constructed of continuous filament fiber.

4.7 Accessory Requirements.

4.7.1 Any accessories attached to any life safety rope or system component shall not interfere with the function of the life safety rope or system component or with the function of any component parts.

4.7.2 Any accessories attached to any life safety rope or system component shall not degrade the designed performance of the life safety rope or system component below the requirements of this standard.

Chapter 5 Performance Requirements

5.1* Life Safety Rope.

5.1.1 Light-use life safety rope shall be tested for breaking strength as specified in 6.1.1, Breaking and Elongation Testing, and shall have a minimum breaking strength of not less than 20 k/N (4496 lbf).

5.1.2 General-use life safety rope shall be tested for breaking strength as specified in 6.1.1, Breaking and Elongation Testing, and shall have a minimum breaking strength of not less than 40 k/N (8992 lbf).

5.1.3* The minimum elongation of all new life safety rope shall not be less than 1 percent at 10 percent of breaking strength when tested as specified in 6.1.1.

5.1.4* The maximum elongation of all new life safety rope shall not be more than 10 percent at 10 percent of breaking strength when tested as specified in 6.1.1.

5.1.5* Light-use life safety rope shall have a diameter 9.5 mm ($^3/_8$ in.) or greater and less than 12.5 mm ($^1/_2$ in.) when tested in accordance with Section 9.1 of Cordage Institute Standard CI 1801, *Low Stretch and Static Kernmantle Life Safety Rope*. For the purpose of reporting, the calculated diameter of all new life safety rope shall be rounded to the nearest 0.5 mm ($^1/_{64}$ in.).

5.1.6* General-use life safety rope shall have a diameter 12.5 mm ($^1/_2$ in.) or greater and not more than 16 mm ($^5/_8$ in.) when tested in accordance with Section 9.1 of Cordage Institute Standard CI 1801, *Low Stretch and Static Kernmantle Life Safety Rope*. For the purpose of reporting, the calculated diameter of all new life safety rope shall be rounded to the nearest 0.5 mm ($^1/_{64}$ in.).

5.1.7* Fiber utilized for all life safety rope shall not have a melting point of less than 204°C (400°F) when tested in accordance with ASTM E 794, *Standard Test Method for Melting and Crystallization Temperatures by Thermal Analysis.*

5.1.8 All dyed life safety rope shall have colorfastness to washing of at least Class 2 color change when tested in accordance with Option A or E of AATCC Test Method 16, *Colorfastness to Light*, for a 10-hour exposure.

5.1.9 The product label(s) and the marking tape specified in Section 3.1 shall be legible to the unaided eye with 20/20 vision, or vision corrected to 20/20, at a nominal distance of 305 mm (12 in.), both before and after the rope with the identification tape inserted and with the product label(s) attached is tested in accordance with Option A or E of AATCC Test Method 16, *Colorfastness to Light*, for a 10-hour exposure.

5.2* Escape Rope System Component.

5.2.1 When tested in accordance with 6.2.1, escape rope shall have a minimum breaking strength of 13.5 k/N (3034 lbf).

5.2.2* The maximum elongation of all new escape rope shall not be less than 1 percent and not more than 10 percent at 10 percent of breaking strength when tested in accordance with 6.2.1.

5.2.3* Escape rope shall have a diameter of 7.5 mm ($^{19}/_{64}$ in.) or greater and less than 9.5 mm ($^3/_8$ in.) when tested in accordance with Section 9.1 of Cordage Institute Standard CI 1801, *Low Stretch and Static Kernmantle Life Safety Rope*. For the purpose of reporting, the calculated diameter of all new life safety escape rope shall be rounded to the nearest 0.5 mm ($^1/_{64}$ in.).

5.2.4* Fiber utilized for all escape rope shall not have a melting point of less than 204°C (400°F) when tested in accordance with ASTM E 794, *Standard Test Method for Melting and Crystallization Temperatures by Thermal Analysis.*

5.2.5 The product label(s) and the marking tape specified in Section 3.1 shall be legible to the unaided eye with 20/20 vision, or vision corrected to 20/20, at a nominal distance of 305 mm (12 in.), both before and after the rope with the identification tape inserted and with the product label(s) attached is tested in accordance with Option A or E of AATCC Test Method 16, *Colorfastness to Light*, for a 10-hour exposure.

5.3 Life Safety Harness System Component.

5.3.1 Samples of each design and model of finished life safety harness shall meet the requirements of this section.

5.3.2 Sample Class I life safety harness shall be tested as specified in 6.3.2. Sample harness shall not release from the test torso, the harness buckles and adjusting devices shall not slip more than 10 mm (0.4 in.), and the harness shall show no visible signs of damage that would affect its function.

5.3.2.1 Sample Class I life safety harness shall be tested as specified in 6.3.5.

5.3.2.2 The test torso shall not contact the ground during any of the two test drops.

5.3.3 Sample Class II life safety harness shall be tested as specified in 6.3.2 and 6.3.4. Sample harness shall not release from the test torso, the harness buckles and adjusting devices shall not slip more than 10 mm (0.4 in.), and the harness shall show no visible signs of damage that would affect its function.

5.3.3.1 Sample Class II life safety harness shall be tested as specified in 6.3.5.

5.3.3.2 The test torso shall not contact the ground during any of the two test drops.

5.3.4 Sample Class III life safety harness shall be tested as specified in 6.3.2, 6.3.3, and 6.3.4. Sample harness shall not release from the test torso, the harness buckles and adjusting devices shall not slip more than 10 mm (0.4 in.), and the harness shall show no visible signs of damage that would affect its function.

5.3.4.1 Sample Class III life safety harness shall be tested as specified in 6.3.5, and the test torso shall not contact the ground during any of the two test drops.

5.3.4.2 For sample Class III life safety harness that include shoulder attachment points, such shoulder attachment points shall be tested as a pair using an appropriate spreader device during the Static Test — Upright only as specified in 6.3.2. The shoulder attachment points shall not release from the test torso and shall show no visible signs of damage that would affect their function.

5.3.5* All fiber and thread used in the construction of all life safety harness shall not have a melting point of less than 204°C (400°F) when tested in accordance with ASTM E 794, *Standard Test Method for Melting and Crystallization Temperatures by Thermal Analysis.*

5.3.6 All dyed life safety harness shall have colorfastness to washing of at least Class 2 color change when tested in accordance with Option A or E of AATCC Test Method 16, *Colorfastness to Light*, for a 10-hour exposure.

5.3.7 The product label(s) specified in Section 3.1 shall remain in place, shall be legible to the unaided eye with 20/20 vision, or vision corrected to 20/20, at a nominal distance of 305 mm (12 in.), and shall not be torn or otherwise damaged when tested for label permanency as specified in 6.3.6.

5.3.8 The product label(s) specified in Section 3.1 shall be legible to the unaided eye with 20/20 vision, or vision corrected to 20/20, at a nominal distance of 305 mm (12 in.), both before and after the harness with the product label(s) attached, is tested in accordance with Option A or E of AATCC Test Method 16, *Colorfastness to Light*, for a 10-hour exposure.

FAIR USE

5.3.9 Product labels used on life safety harnesses system components shall be tested as specified in 6.5.8. Product labels shall not melt, ignite, or separate and shall be legible to the unaided eye with 20/20 vision, or vision corrected to 20/20, at a nominal distance of 305 mm (12 in.).

5.4 Belt System Component.

5.4.1 Samples of each design and model of finished belts shall meet the requirements of this section.

5.4.2 Sample ladder belts shall be tested as specified in 6.4.2 and 6.4.3. Sample ladder belts shall not release from the test torso, the belt buckles and adjusting devices shall not slip more than 10 mm (0.4 in.), and the belt shall show no visible signs of damage that would affect its function.

5.4.3 Sample escape belts shall be tested as specified in 6.4.2 and 6.4.3. Sample escape belts shall not release from the test torso, the belt buckles and adjusting devices shall not slip more than 10 mm (0.4 in.), and the belt shall show no visible signs of damage that would affect its function.

5.4.3.1 Sample escape belts shall be tested as specified in 6.4.4.

5.4.3.2 The test torso shall not contact the ground during any of the two test drops.

5.4.4* All fiber and thread used in the construction of all belts shall not have a melting point of less than 204°C (400°F) when tested in accordance with ASTM E 794, *Standard Test Method for Melting and Crystallization Temperatures by Thermal Analysis.*

5.4.5 All dyed belts shall have colorfastness to washing of at least Class 2 color change when tested in accordance with Option A or E of AATCC Test Method 16, *Colorfastness to Light*, for a 10-hour exposure.

5.4.6 The product label(s) specified in Section 3.1 shall remain in place, shall be legible to the unaided eye with 20/20 vision, or vision corrected to 20/20, at a nominal distance of 305 mm (12 in.), and shall not be torn or otherwise damaged when tested for label permanency as specified in 6.4.5.

5.4.7 The product label(s) specified in Section 3.1 shall be legible to the unaided eye with 20/20 vision, or vision corrected to 20/20, at a nominal distance of 305 mm (12 in.), both before and after the belt with the product label(s) attached is tested in accordance with Option A or E of AATCC Test Method 16, *Colorfastness to Light*, for a 10-hour exposure.

5.4.8 Product label(s) specified in Section 3.1 shall be tested as specified in 6.5.8. Product labels shall not melt, ignite, or separate and shall be legible to the unaided eye with 20/20 vision, or vision corrected to 20/20, at a nominal distance of 305 mm (12 in.).

FAIR USE

5.5 Auxiliary Equipment System Components.

5.5.1 Carabiners and Snap-Link System Components.

5.5.1.1 When tested in accordance with 6.5.1, light-use carabiners and snap-links, with the gate closed, shall have a major axis minimum breaking strength of at least 27 k/N (6069 lbf).

5.5.1.2 When tested in accordance with 6.5.1, light-use carabiners and snap-links, with the gate open, shall have a major axis minimum breaking strength of at least 7 k/N (1574 lbf).

5.5.1.3 When tested in accordance with 6.5.1, light-use carabiners and snap-links shall have a minor axis minimum breaking strength of at least 7 k/N (1574 lbf).

5.5.1.4 When tested in accordance with 6.5.1, general-use carabiners and snap-links, with the gate closed, shall have a major axis minimum breaking strength of at least 40 k/N (8992 lbf).

5.5.1.5 When tested in accordance with 6.5.1, general-use carabiners and snap-links, with the gate open, shall have a major axis breaking strength of at least 11 k/N (2473 lbf).

5.5.1.6 When tested in accordance with 6.5.1, general-use carabiners and snap-links shall have a minor axis minimum breaking strength of at least 11 k/N (2473 lbf).

5.5.2 Ascending and Rope Grab Device System Component.

5.5.2.1 Ascending device auxiliary equipment shall be strength tested in the manner of function as specified in 6.5.2 and shall withstand a minimum test load of at least 5 k/N (1124 lbf) without permanent damage to the device or damage to the rope.

5.5.2.2 Rope grab device auxiliary equipment designated by the manufacturer for general use shall be strength tested in the manner of function as specified in 6.5.2 and shall withstand a minimum test load of at least 11 k/N (2473 lbf) without permanent damage to the device or damage to the rope.

5.5.3 Descent Control System Components.

5.5.3.1 Descent control device auxiliary equipment shall be strength tested in the manner of function as specified in 6.5.3.

5.5.3.2 Escape descent control devices shall withstand a minimum test load of at least 5 k/N (1124 lbf) without permanent damage or visible deformation to the general shape of the device or damage to the rope when tested in the manner of function in accordance with 6.5.3.

5.5.3.3 Escape descent control devices shall withstand a minimum test load of at least 13.5 k/N (3034 lbf) without failure when tested in accordance with 6.5.3.

5.5.3.4 Light-use descent control devices shall withstand a minimum test load of at least 5 k/N (1124 lbf) without permanent damage or visible deformation to the general shape of the device or damage to the rope when tested in accordance with 6.5.3.

5.5.3.5 Light-use descent control devices shall withstand a minimum test load of at least 13.5 k/N (3034 lbf) without failure when tested in accordance with 6.5.3.

5.5.3.6 General-use descent control devices shall withstand a minimum test load of at least 5 k/N (1124 lbf) without permanent damage or visible deformation to the general shape of the device or damage to the rope when tested in accordance with 6.5.3.

5.5.3.7 General-use descent control devices shall withstand a minimum test load of at least 22 k/N (4946 lbf) without failure when tested in accordance with 6.5.3.

5.5.4 Portable Anchor System Components.

5.5.4.1 When tested in accordance with 6.5.4, light-use portable anchor devices shall withstand a minimum load of at least 5 k/N (1124 lbf) without permanent damage or visible deformation to the general shape of the device.

5.5.4.2 When tested in accordance with 6.5.4, light-use portable anchor devices shall withstand a minimum load of at least 22 k/N (4946 lbf) without failure.

5.5.4.3 When tested in accordance with 6.5.4, general-use portable anchor devices shall withstand a minimum load of at least 13 k/N (2923 lbf) without permanent damage or visible deformation to the general shape of the device.

5.5.4.4 When tested in accordance with 6.5.4, general-use portable anchor devices shall withstand a minimum load of at least 36 k/N (8093 lbf) without failure.

5.5.5 Pulley System Components.

5.5.5.1 When tested in accordance with 6.5.5, light-use pulleys shall have a minimum tensile strength of at least 5 k/N (1124 lbf) without permanent damage to the device or damage to the rope.

5.5.5.2 When tested in accordance with 6.5.5, light-use pulleys shall have a minimum tensile strength of at least 22 k/N (4946 lbf) without failure.

5.5.5.3 When tested in accordance with 6.5.5, general-use pulleys shall have a minimum tensile strength of at least 22 k/N (4946 lbf) without permanent damage to the device or damage to the rope.

5.5.5.4 When tested in accordance with 6.5.5, general-use pulleys shall have a minimum tensile strength of at least 36 k/N (8093 lbf) without failure.

5.5.5.5 When tested in accordance with 6.5.5, the becket on light-use pulleys shall have a minimum tensile strength of at least 12 k/N (3709 lbf) without failure.

5.5.5.6 When tested in accordance with 6.5.5, the becket on general-use pulleys shall have a minimum tensile strength of at least 19.5 k/N (6070 lbf) without failure.

5.5.6 Auxiliary Equipment, Systems, System Components, and Manufactured Systems.

5.5.6.1 All other auxiliary equipment, systems, system components, and manufactured systems designated by the manufacturer for light use or general use that are not specifically addressed in this section shall be strength tested in accordance with Section 6.6.

5.5.6.2 When tested in accordance with Section 6.6, light-use auxiliary equipment, systems, system components, and manufactured systems specified in 5.5.6.1 shall have a minimum tensile strength of at least 22 k/N (4946 lbf) without failure.

5.5.6.3 When tested in accordance with Section 6.6, general-use auxiliary equipment, systems, system components, and manufactured systems specified in 5.5.6.1 shall have a minimum tensile strength of at least 36 k/N (8093 lbf) without failure.

FAIR USE

5.5.6.4 All auxiliary equipment, systems, system components, and manufactured systems with metal hardware and hardware that includes metal parts shall be tested for corrosion resistance as specified in 6.5.6. Metals inherently resistant to corrosion including but not limited to stainless steel, brass, copper, aluminum, and zinc shall show no more than light surface–type corrosion or oxidation. Ferrous metals shall show no corrosion of the base metal. All hardware shall remain functional as specified in the manufacturers' operating instructions.

5.5.6.5* All fiber and thread utilized in the construction of all auxiliary equipment, systems, system components, and manufactured systems shall not have a melting point of less than 204°C (400°F) when tested in accordance with ASTM E 794, *Standard Test Method for Melting and Crystallization Temperatures by Thermal Analysis.*

5.5.6.6 All dyed auxiliary equipment, systems, system components, and manufactured systems shall have a colorfastness to washing of at least Class 2 color change when tested in accordance with Option A or E of AATCC Test Method 16, *Colorfastness to Light*, for a 10-hour exposure.

5.5.6.7 Where the product label specified in 3.1.1 and 3.1.6 is attached and is a synthetic fabric label, the product label shall be tested in accordance with 6.5.7, shall remain in place, shall be legible to the unaided eye with 20/20 vision, or vision corrected to 20/20, at a nominal distance of 305 mm (12 in.), and shall not be torn or otherwise damaged.

5.5.6.8 Where the product label specified in 3.1.1 and 3.1.6 is attached and is a synthetic fabric label, the product label shall be legible to the unaided eye with 20/20 vision, or vision corrected to 20/20, at the nominal distance of 305 mm (12 in.), both before and after the auxiliary equipment, systems, system components, and manufactured systems with the product label(s) attached that has been subjected to the washing test specified in 5.5.6.6.

5.6 Manufactured Systems.

5.6.1 Where a manufactured system contains a life safety harness subcomponent, the life safety harness shall be individually tested, labeled, and certified to meet the appropriate requirements specified in Section 5.3 in addition to the manufactured system requirements of 5.6.2 through 5.6.5 as applicable.

5.6.2 When tested in accordance with Section 6.6, light-use manufactured systems shall have a minimum tensile strength of at least 5 k/N (1124 lbf) without permanent damage to the system or its component parts or visible deformation to the general shape of the system or components.

5.6.3 When tested in accordance with Section 6.6, light-use manufactured systems shall have a minimum tensile strength of at least 22 k/N (4946 lbf) without failure.

5.6.4 When tested in accordance with Section 6.6, general-use manufactured systems shall have a minimum tensile strength of at least 22 k/N (4946 lbf) without permanent damage to the system or its component parts or visible deformation to the general shape of the system or components.

5.6.5 When tested in accordance with Section 6.6, general-use manufactured systems shall have a minimum tensile strength of at least 36 k/N (8993 lbf) without failure.

5.7 Throwline.

5.7.1 The minimum breaking strength for new throwline shall not be less than 13 k/N (2923 lbf) when tested as specified in 6.7.1.

5.7.2 The diameter of all new throwline shall have a diameter of 7 mm ($^{19}/_{64}$ in.) or greater and less than 9.5 mm ($^{3}/_{8}$ in.) when tested in accordance with Section 9.1 of Cordage Institute Standard CI 1801, *Low Stretch and Static Kernmantle Life Safety Rope.*

5.7.3 New throwline shall float when tested as specified in 6.7.2.

5.7.4 All dyed throwline shall have colorfastness to washing of at least Class 2 color change when tested in accordance with Option A or E of AATCC Test Method 16, *Colorfastness to Light*, for a 10-hour exposure.

5.7.5 The product label(s) and the marking tape specified in Section 3.1 shall be legible to the unaided eye with 20/20 vision, or corrected to 20/20, at a nominal distance of 305 mm (12 in.), both before and after the rope with the identification tape inserted and with the product label(s) attached has been subjected to the washing test specified in 5.7.4.

Chapter 6 Testing Requirements

6.1 Life Safety Rope.

6.1.1 Breaking and Elongation Testing.

6.1.1.1* Samples of life safety rope shall be tested for elongation and minimum breaking strength in accordance with Sections 8 and 9 of Cordage Institute Standard CI 1801, *Low Stretch and Static Kernmantle Life Safety Rope.*

6.1.1.2 New rope minimum breaking strength shall be determined by subtracting three standard deviations from the mean result of five samples from the same production lot. The standard deviation shall be calculated using the formula:

$$s = \sqrt{\frac{n(\Sigma x^2) - (\Sigma x)^2}{n(n-1)}}$$

where:

s = Standard deviation
n = Number of samples
x = Breaking strength

6.1.1.3 Test results and calculations shall be examined to determine pass/fail.

6.2 Escape Rope System Component.

6.2.1 Breaking and Elongation Testing.

6.2.1.1 Samples of escape rope shall be tested for elongation and minimum breaking strength in accordance with Sections 8 and 9 of Cordage Institute Standard CI 1801, *Low Stretch and Static Kernmantle Life Safety Rope.*

6.2.1.2 New escape rope minimum breaking strength shall be determined by subtracting three standard deviations from the mean result of five samples from the same production lot. The standard deviation shall be calculated using the formula:

$$s = \sqrt{\frac{n(\Sigma x^2) - (\Sigma x)^2}{n(n-1)}}$$

where:

s = Standard deviation
n = Number of samples
x = Breaking strength

6.2.1.3 Test results and calculations shall be examined to determine pass/fail.

6.3 Life Safety Harness System Component.

6.3.1 Testing Set-Up.

6.3.1.1* Each model of life safety harness shall be tested according to Table 6.3.1.1, as appropriate for the class of harness. Each test shall be conducted on at least three samples of the model to be tested. Submitted test samples shall be new and in unused condition and shall conform in all respects to the manufacturer's specifications for the model to be tested.

Table 6.3.1.1 Harness Test Matrix

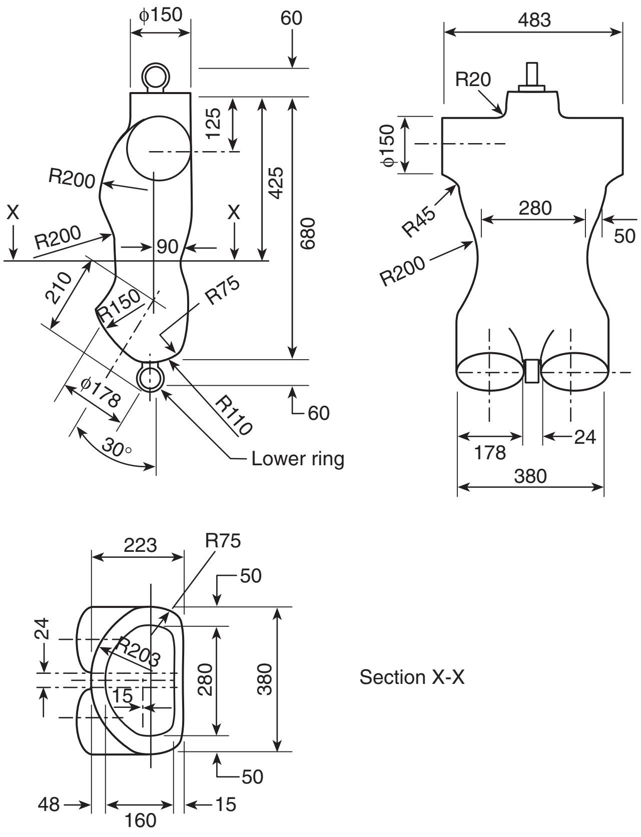
Test	Class I	Class II	Class III
6.3.2 (Upright)	YES	YES	YES
6.3.3 (Head Down)	NO	NO	YES
6.3.4 (Horizontal)	NO	YES	YES
6.3.5 (Drop)	YES	YES	YES

6.3.1.1.1 If there are multiple load-bearing connecting points, all tests shall be repeated for each combination of load-bearing connecting points specified in the manufacturer's instructions or as specified in 6.3.1.1.2.

6.3.1.1.2 For sample Class III harness that include shoulder attachment points, the shoulder attachment points shall be required to pass only the Static Test — Upright specified in 6.3.2.

6.3.1.2 For all tests, samples shall be put on and secured to a rigid test torso as specified in Figure 6.3.1.2. The rigid test torso shall weigh 136 kg, ±1 kg (300 lb, ±2.2 lb). The test torso with the sample harness attached shall be identified as the test mass.

FIGURE 6.3.1.2 Outline of the test torso.



Notes: Waist circumference at X-X is 750 mm.
All linear dimensions are in millimeters, ± 5 mm.
The dimensions are those of a dummy developed by the UIAA for testing harnesses.

FAIR USE

6.3.1.3 For all static tests, the test mass shall be attached to the test machine at the load-bearing connecting point, in accordance with the manufacturers' instruction for use, with a suitable locking carabiner.

6.3.1.4 For all static tests, each sample shall be secured to the test torso, that is, the test mass, and shall be tested first in the upright position as specified in 6.3.2, then tested as applicable, in accordance with Table 6.3.1.1, in the head-down position as specified in 6.3.3, and finally in the horizontal position as specified in 6.3.4.

6.3.1.5 For the drop test, each sample shall be secured to the test torso, that is, the test mass, and shall be connected to a drop tower anchorage point that shall not have a deflection greater than 1 mm (0.04 in.) when a force of 10 k/N (2250 lbf) is applied.

6.3.1.6 For the drop test, the test lanyard used to connect the load-bearing connecting point(s) to the test mass shall be fabricated from Type 302 stainless steel, 7 × 19 aircraft cable construction in accordance with MIL-W-83420D. The lanyard shall be 9.5 mm ($^3/_8$ in.) in diameter and 1.2 m, ±13 mm (47 in., ±$^1/_2$ in.) in length measured from bearing point to bearing point between snap hooks when the lanyard is under a tension of 50 N (1 lbf). The lanyard shall be equipped with a snap hook at each end. The lanyard ends shall be finished with swaged eyes in such a manner as to prevent slippage of the eyes and snap hooks that would change the length of the test lanyard.

6.3.2 Static Test — Upright.

6.3.2.1 The Static Test — Upright shall be set up as specified in 6.3.1.

6.3.2.2 The test mass shall be properly positioned by preloading up to 800 N (181 lbf) with the test torso in the upright position. Under this load, the load-bearing connecting point(s) shall be placed approximately symmetrically about the vertical axis of the test torso.

6.3.2.3* For the Static Test — Upright, the test torso shall be in an upright position. A force shall be applied to the buttocks ring, increasing to 22 k/N (4946 lbf) over a period of 2 minutes, ±0.25 minute. This force shall be held for 1 minute, ±0.25 minute and then tension shall be completely released over a maximum of 1 minute. The force shall be reapplied immediately and shall be increased to 22 k/N (4946 lbf) as before and held for 5 minutes, ±0.25 minute before release.

6.3.2.4 At the conclusion of the Static Test — Upright series, the sample harness shall be inspected to determine pass/fail. A harness shall be considered to be damaged to the point of failing this test if any load-bearing material is torn or otherwise destroyed, if a buckle becomes nonfunctional, or any other condition exists that would cause the safety of the user to be compromised.

FAIR USE

6.3.3 Static Test — Head Down.

6.3.3.1 The Static Test — Head Down shall be set up as specified in 6.3.1.

6.3.3.2 The test mass shall be properly positioned by preloading up to 800 N (181 lbf) with the test torso in the upright position. Under this load, the load-bearing connecting point(s) shall be placed approximately symmetrically about the vertical axis of the test torso.

6.3.3.3* For the Static Test — Head Down, the test torso shall be oriented in a head-down position. A force shall be applied to the neck ring, increasing to 10 k/N (2248 lbf) over a period of 2 minutes, ±0.25 minute. This force shall be held for 1 minute, ±0.25 minute and then the tension shall be completely released over a maximum of 1 minute. The force shall be reapplied immediately and shall be increased to 10 k/N (2248 lbf) as before and held for 5 minutes, ± 0.25 minute before release.

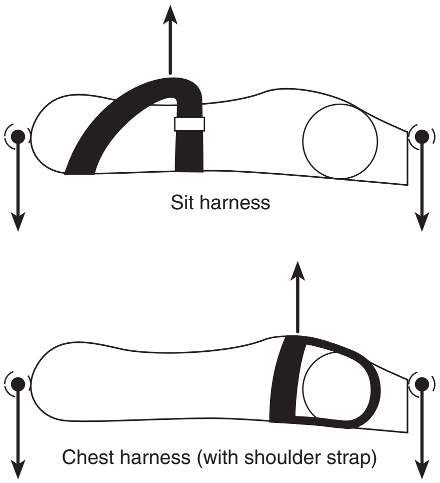
6.3.3.4 At the conclusion of the Static Test — Head Down series, the sample harness shall be inspected to determine pass/fail. A harness shall be considered to be damaged to the point of failing this test if any load-bearing material is torn or otherwise destroyed, if a buckle becomes nonfunctional, or any other condition exists that would cause the safety of the user to be compromised.

6.3.4 Static Test — Horizontal.

6.3.4.1 The Static Test — Horizontal shall be set up as specified in 6.3.1.

6.3.4.2 The test mass shall be properly positioned by preloading up to 800 N (181 lbf) with the test torso in the upright position. Under this load, the load-bearing connecting point(s) shall be placed approximately symmetrically about the vertical axis of the test torso as shown in Figure 6.3.4.2.

FIGURE 6.3.4.2 Test torso orientations for harness test.



6.3.4.3 For the Static Test — Horizontal, the test torso shall be positioned in a horizontal position supported by the neck and buttocks rings. A force shall be applied to the neck and buttocks rings in the plane of symmetry of the test torso and normal to its axis as shown in Figure 6.3.4.2. The force shall be increased to 10 k/N (2248 lbf) over a period of 2 minutes, ±0.25 minute. This force shall be held for 1 minute, ±0.25 minute and then the tension shall be completely released over a maximum of 1 minute. The force shall be reapplied immediately and increased to 10 k/N (2248 lbf) as before and held for 5 minutes, ±0.25 minute before release.

6.3.4.4 At the conclusion of the Static Test — Horizontal series, the sample harness shall be inspected to determine pass/fail. A harness shall be considered to be damaged to the point of failing this test if any load-bearing material is torn or otherwise destroyed, if a buckle becomes nonfunctional, or any other condition exists that would cause the safety of the user to be compromised.

6.3.5 Dynamic Drop Test.

6.3.5.1 The Dynamic Drop Test shall be set up as specified in 6.3.1.

6.3.5.2 One of the two required Dynamic Drop Tests shall be conducted for each harness load-bearing attachment point with the test mass in a head-up position, and the second shall be conducted for each harness load-bearing attachment point with the test mass in a head-down position.

6.3.5.3 One end of the test lanyard shall be attached to a harness load-bearing attachment point, and the other end shall be to the anchorage. The test mass shall be raised to and released from a point no more than 305 mm (12 in.) horizontally from the anchorage. The test mass shall be in a position that will allow it to fall freely a distance of 1 m (39 in.) to a free-hanging position without interference or obstruction or striking the floor, ground, or any other object during the test.

6.3.5.4 During the Dynamic Drop Test series, the test drops shall be observed to determine pass/fail. A harness shall be considered to have failed the test if, during any one of the required drops for any sample, the test mass impacts the ground.

6.3.6 Product Label Permanency Test.

6.3.6.1 Test specimens of synthetic fabric product label samples shall be tested in accordance with ASTM D 4966, *Standard Test Method for Abrasion Resistance of Textile Fabrics.*

6.3.6.2 At least four test specimens shall be cut from product label(s) samples. At least two test specimens shall include the edge of the product label(s).

6.3.6.3 At least two test specimens shall be subjected to 160 dry abrasion revolutions, 10 cycles, and at least two test specimens shall be subjected to 80 wet abrasion revolutions, 5 cycles. At least one dry and one wet test specimen shall be edge specimens.

6.3.6.4 Test specimens shall then be examined visually with the unaided eye to determine pass/fail.

FAIR USE

6.4 Belt System Component.

6.4.1 Testing Set-Up.

6.4.1.1* Each model of belt shall be tested according to Table 6.4.1.1 for the appropriate belt. Each test shall be conducted on at least three samples of the model to be tested. Submitted test samples shall be new and in unused condition and shall conform in all respects to the manufacturers' specifications for the model to be used.

Table 6.4.1.1 Belt Test Matrix

	Belt Types	
Test	**Ladder Belt**	**Escape Belt**
6.4.2 (Upright)	YES	YES
6.4.3 (Horizontal)	YES	YES
6.4.4 (Drop)	NO	YES

6.4.1.1.1 If there are multiple load-bearing connecting points, all tests shall be repeated for each combination of load-bearing connecting points specified in the manufacturer's instructions.

6.4.1.2 For all tests, samples shall be put on and secured to a rigid test torso as specified in Figure 6.3.1.2. The rigid test torso shall weigh 136 kg (300 lb). The sample belt secured to the test torso shall be identified as the test mass.

6.4.1.3 For all static tests, the test mass shall be attached to the test machine at the load-bearing connecting point, in accordance with the manufacturer's instruction for use, with a suitable locking carabiner.

6.4.1.4 For all static tests, each sample shall be secured to the test torso, that is, the test mass, and each sample shall be tested twice, first in the upright position as specified in 6.4.2, then in the horizontal position as specified in 6.4.3.

6.4.1.5 For the drop test, each sample shall be to secure the test torso, that is, the test mass, and shall be connected to a drop tower anchorage point that shall not have a deflection greater than 1 mm (0.04 in.) when a force of 10 k/N (2250 lbf) is applied.

6.4.1.6 For the drop test, the test lanyard used to connect the load-bearing connecting point(s) to the test mass shall be fabricated from Type 302 stainless steel, 7 × 19 aircraft cable construction in accordance with MIL-W-83420D. The lanyard shall be of 9.5 mm ($^3/_8$ in.) in diameter and be 1.2 m, ±13 mm (47 in., ±$^1/_2$ in.) in length. The lanyard shall be equipped with a snap hook at each end and measured from bearing point to bearing point between snap hooks when the lanyard is under a tension of 50 N (1 lbf). The lanyard ends shall be finished with swaged eyes in such a manner as to prevent slippage of the eyes and snap hooks that would change the length of the test lanyard.

6.4.2 Static Test — Upright.

6.4.2.1 The Static Test — Upright shall be set up as specified in 6.4.1.

6.4.2.2 The test mass shall be properly positioned by preloading up to 800 N (181 lbf) with the test torso in the upright position. Under this load, the load-bearing connecting point(s) shall be placed approximately symmetrically about the vertical axis of the test torso.

6.4.2.3* For the Static Test — Upright, the test torso shall be in an upright position. A force shall be applied to the buttocks ring, increasing to 13 k/N (2923 lbf) over a period of 2 minutes, ±0.25 minute. This force shall be held for 1 minute, ±0.25 minute and then tension shall be completely released over a maximum of 1 minute. The force shall be reapplied immediately and shall be increased to 13 k/N (2923 lbf) as before and held for 5 minutes, ±0.25 minute before release.

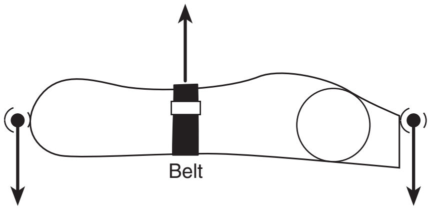
6.4.2.4 At the conclusion of the Static Test — Upright series, sample belts shall be inspected to determine pass/fail. A belt shall be considered to be damaged to the point of failing this test if any load-bearing material is torn or otherwise destroyed, if a buckle becomes nonfunctional, or any other condition exists that would cause the safety of the user to be compromised.

6.4.3 Static Test — Horizontal.

6.4.3.1 The Static Test — Horizontal shall be set up as specified in 6.4.1.

6.4.3.2 The test mass shall be properly positioned by preloading up to 800 N (181 lbf) with the test torso in the upright position. Under this load, the load-bearing connecting point(s) shall be placed approximately symmetrically about the vertical axis of the test torso as shown in Figure 6.4.3.2.

FIGURE 6.4.3.2 Test torso orientations for belt test.



6.4.3.3 For the Static Test — Horizontal, the test torso shall be in a horizontal position supported by the neck and buttocks rings. A force shall be applied to the neck and buttocks rings in the plane of symmetry of the test torso and normal to its axis as shown in Figure 6.4.3.2. The force shall be increased to 10 k/N (2248 lbf) over a period of 2 minutes, ±0.25 minute. This force shall be held for 1 minute, ±0.25 minute and then the tension shall be completely released over a maximum of 1 minute. The force shall be reapplied immediately and increased to 10 k/N (2248 lbf) as before and held for 5 minutes, ±0.25 minute before release.

6.4.3.4 At the conclusion of the Static Test — Horizontal series, the sample belts shall be inspected to determine pass/fail. A belt shall be considered to be damaged to the point of failing this test if any load-bearing material is torn or otherwise destroyed, if a buckle becomes nonfunctional, or any other condition exists that would cause the safety of the user to be compromised.

6.4.4 Dynamic Drop Test.

6.4.4.1 The Dynamic Drop Test shall be set up as specified in 6.4.1.

6.4.4.2 There shall be two drop tests for each sample. One of the two required Dynamic Drop Tests for each sample shall be conducted with the test mass in a head-up position, and one of the Dynamic Drop Tests shall be conducted with the test mass in a head-down position.

6.4.4.3 One end of the test lanyard shall be attached to a harness load-bearing attachment point, and the other end shall be to the anchorage. The test mass shall be raised to and released from a point no more than 305 mm (12 in.) horizontally from the anchorage. The test mass shall be in a position that will allow it to fall freely a distance of 1 m (39 in.) to a free-hanging position without interference or obstruction, or striking the floor, ground, or any other object during the test.

6.4.4.4 During the Dynamic Drop Test series, the test drops shall be observed to determine pass/fail. A belt shall be considered to have failed the test if, during any one of the required drops for any sample, the test mass impacts the ground.

6.4.5 Product Label Permanency Test.

6.4.5.1 Test specimens of synthetic fabric product label samples shall be tested in accordance with ASTM D 4966, *Standard Test Method for Abrasion Resistance of Textile Fabrics.*

6.4.5.2 At least four test specimens shall be cut from product label(s) samples. At least two test specimens shall include the edge of the product label(s).

6.4.5.3 At least two test specimens shall be subjected to 160 dry abrasion revolutions, 10 cycles, and at least two test specimens shall be subjected to 80 wet abrasion revolutions, 5 cycles. At least one dry and one wet test specimen shall be edge specimens.

6.4.5.4 Test specimens shall then be examined visually with the unaided eye to determine pass/fail.

6.5 Auxiliary Equipment System Components.

6.5.1 Carabiner and Snap-Link Tensile Testing.

6.5.1.1 Carabiner and snap-link auxiliary equipment system component tensile tests shall be conducted at a rate of pull of 30 mm/min, ±5 mm/min (1.18 in./min, ±0.2 in./min).

6.5.1.2 Carabiner and snap-link auxiliary equipment system component tensile tests shall be conducted utilizing nonrotating pins.

6.5.1.2.1* Test pins shall be AISI SAE Type 01 Tool Steel, heat treated to a minimum Rockwell hardness, C scale 60.

6.5.1.2.2 The mean surface roughness, R_a, shall not exceed 0.8 micron and the peak to valley height, R_{max}, shall not exceed 6.3 microns.

6.5.1.2.3 Test pin cross-section shall be permitted to be other than round. Any cross-section necessary to prevent test pin failure or any design to prevent test pin rotation shall be acceptable as long as the contact point of the test pin between the test pin and carabiner has the specified radius, material type, hardness, and surface roughness.

6.5.1.2.4 The pins shall be lubricated with molybdenum-based grease at the point of contact between the test pins and the carabiner.

6.5.1.2.5 The fixture shall be designed to prevent the test pins from rotating and so that the carabiner is free to locate itself on the test pins when force is applied.

6.5.1.3 At least five randomly selected samples shall constitute a test series for each model of carabiner or snap-link. A separate test series shall be tested for each performance requirement.

6.5.1.4 Both light-use and general-use designated carabiners and snap-links shall be tested in the manner of function at the specified force for major axis minimum breaking strength with gate closed as shown in Figure 6.5.1.4.

6.5.1.5 Both light-use and general-use designated carabiners and snap-links shall be tested in the manner of function at the specified force for major axis minimum breaking strength with gate open as shown in Figure 6.5.1.5.

6.5.1.6 Both light-use and general-use designated carabiners and snap-links shall be set up for testing for minor axis minimum breaking strength as shown in Figure 6.5.1.6.

6.5.1.7 Both light-use and general-use designated carabiners and snap-links shall be tested in the manner of function at the specified force for minor axis minimum breaking strength as shown in Figure 6.5.1.7.

6.5.1.8 The tests shall be observed to determine pass/fail.

FAIR USE

FIGURE 6.5.1.4 Major axis — gate closed test.

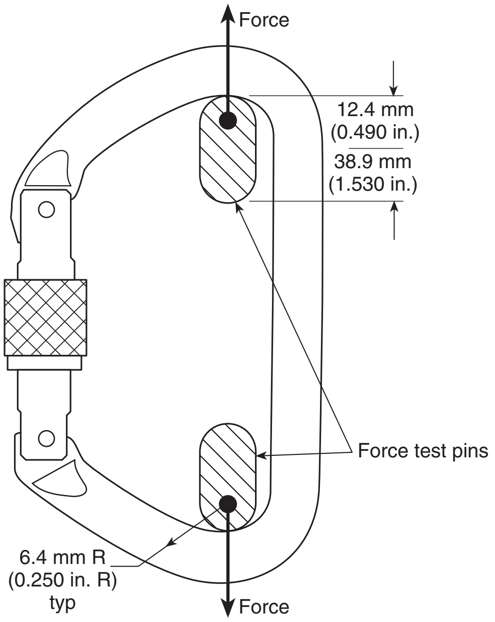
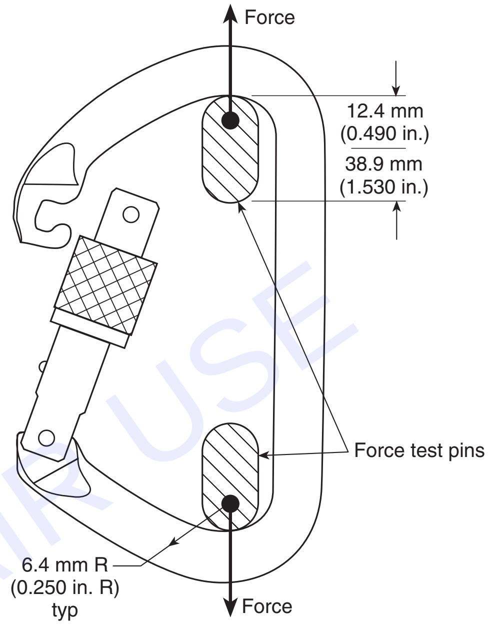


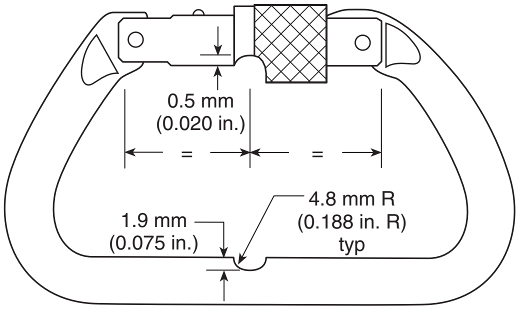
FIGURE 6.5.1.5 Major axis — gate open test.



All tolerances ± 0.013 mm (0.005 in.) unless otherwise specified.

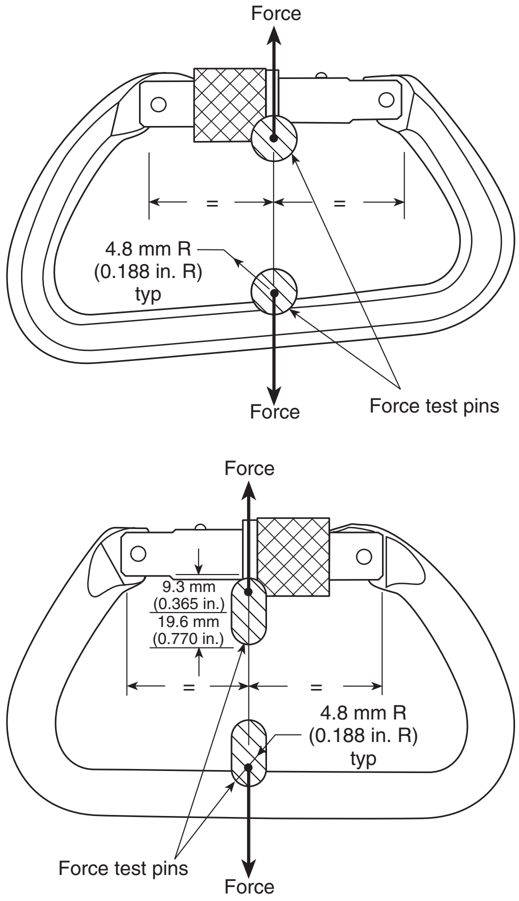
FAIR USE

FIGURE 6.5.1.6 Minor axis test set-up.



All tolerances ± 0.013 mm (0.005 in.)

FIGURE 6.5.1.7 Minor axis test.



6.5.2 Ascending and Rope Grab Devices Testing.

6.5.2.1 This test shall apply to both light-use and general-use designated ascending and rope grab devices.

6.5.2.2 At least five randomly selected samples shall constitute a test series for each model of ascending device or rope grab device.

6.5.2.3 The "manner of function" static test for light-use ascending devices shall be with the device attached onto a life safety rope meeting the "static rope" requirements of Cordage Institute Standard CI 1801, *Low Stretch and Static Kernmantle Life Safety Rope,* with a diameter of 9.5 mm ($^3/_8$ in.).

6.5.2.4 The "manner of function" static test for general-use rope grab devices shall be with the device attached onto a life safety rope meeting the "static rope" requirements of Cordage Institute Standard CI 1801, *Low Stretch and Static Kernmantle Life Safety Rope,* with a diameter of 12.5 mm ($^1/_2$ in.).

6.5.2.5 The device shall be attached to the rope in the manner intended according to the manufacturers' instructions. With the end of the rope anchored, the specified force shall be applied to the device at the normal attachment point for 30 seconds. In the case of ascending devices or rope grabs that are designed to slip under load, the rope shall be knotted or the device otherwise blocked to prevent slippage.

6.5.2.6 The test shall be observed and the device and rope shall be examined to determine pass/fail.

6.5.2.7 Where the average breaking strength exceeds 40 k/N without failure, the average breaking strength shall be reported as >40 k/N. The product label required in 3.1.6 shall also indicate the minimum breaking strength as >40 k/N.

6.5.3 Descent Control Devices Testing.

6.5.3.1 The static tests shall apply to escape, light-use, and general-use designated descent control devices.

6.5.3.2 Descent control device auxiliary equipment system component tensile tests shall be conducted at a rate of pull of 30 mm/min, ±5 mm/min (1.18 in./min, ±0.2 in./min).

6.5.3.3 At least five randomly selected samples shall constitute a test series for each model of descent control device.

6.5.3.4 The “manner of function” static test for escape descent control devices shall be with the device attached onto an escape rope meeting the “static rope” requirements of Cordage Institute Standard CI 1801, *Low Stretch and Static Kernmantle Life Safety Rope*, with a diameter of 8 mm ($^5/_{16}$ in.).

6.5.3.5 The “manner of function” static test for light-use descent control devices shall be with the device attached onto a life safety rope meeting the “static rope” requirements of Cordage Institute Standard CI 1801, *Low Stretch and Static Kernmantle Life Safety Rope,* with a diameter of 9.5 mm ($^3/_8$ in.).

6.5.3.6 The “manner of function” static test for general-use descent control devices shall be with the device attached onto a life safety rope meeting the “static rope” requirements of Cordage Institute Standard CI 1801, *Low Stretch and Static Kernmantle Life Safety Rope*, with a diameter of 12.5 mm ($^1/_2$ in.).

6.5.3.7 The device shall be attached to the rope in the manner intended according to the manufacturers’ instructions in the locked-off mode of attachment. With the opposite end of the rope anchored, the specified force shall be applied to the device for a period of at least 30 seconds.

6.5.3.8 The test shall be observed and the device and rope shall be examined, as applicable, to determine pass/fail.

6.5.3.9 Where the average breaking strength exceeds 40 k/N without failure, the average breaking strength shall be reported as >40 k/N. The product label required in 3.1.6 shall also indicate the minimum breaking strength as >40 k/N.

6.5.4 Portable Anchor Testing.

6.5.4.1 Testing Set-Up.

6.5.4.1.1 Samples of each model of each portable anchor device shall be selected randomly for testing. Test samples shall be new and in an unused condition and shall conform in all respects to the manufacturers’ specifications for the model to be tested. A total of at least two samples of each model of portable anchor device shall be required for each test specified.

6.5.4.1.2 Where there are multiple load-bearing connection points, all tests shall be repeated for each combination of load-bearing connecting points specified in the manufacturers’ instructions.

6.5.4.1.3 For all static tests, the device shall be attached to the test machine at the load-bearing connecting point, in accordance with the manufacturers’ instructions for use, with a suitable locking carabiner.

6.5.4.1.4* For both static tests, the portable anchor device shall be positioned on a flat, unfinished concrete surface in the manner described by the manufacturers’ instructions for use. Where portable anchor devices are designed to be affixed to a base that is not part of the device, the manufacturer shall provide a test base that most closely resembles the structural element to which the device is designed to be affixed. This test base shall be completely stable and shall be permitted to be bolted down to prevent movement during the test.

6.5.4.1.5 For all static tests, the portable anchor device shall be accompanied by all adjuncts required for use as described by the manufacturers’ instructions for use. Devices shall not be bolted, tied off, or affixed to the test base in any way unless required by the manufacturer for normal use. All adjuncts designed by the manufacturer to be used in conjunction with the device, including but not limited to ropes, chains, webbing, rope grabs, and bolts shall be in place during the test.

6.5.4.1.6* Manufacturers shall designate the device as either light use or general use based on the weakest extension for which it was designed. For all static tests, the portable anchor device shall be configured at its weakest extension designed for use in accordance with the manufacturer’s instructions for use.

6.5.4.1.7 For the static load test with portable anchor devices, each point of contact with the test surface shall be marked in some manner to allow the ability to assess movement of the base during the test.

6.5.4.2 Static Load Test.

6.5.4.2.1 The Static Load Test shall be set up as specified in 6.5.4.1

6.5.4.2.2 The device shall be positioned according to manufacturers’ instructions with all surface contact points securely seated before testing.

6.5.4.2.3 A force shall be applied to the portable anchor device, increasing to the load specified in 5.5.4.2 for light-use testing and 5.5.4.4 for general-use testing at a rate of 30 mm/min, ±5 mm/min (1.2 in./min, ±0.2 in./min). The force shall be held for 30 seconds, ±1.0 second, and then the tension shall be completely released over a maximum of 1 minute. The force shall be reapplied immediately and shall be increased to the same maximum force as previously exerted and held for 1 minute, ±15 seconds before release.

6.5.4.2.4 At the conclusion of the Static Load Test described in 6.5.4.2, the sample portable anchor device shall be inspected to determine pass/fail. A portable anchor device shall be considered to fail if any of the load-bearing members remain deflected by more than 25 mm (1 in.) from their original position. If an adjustment or moving part becomes nonfunctional, any base contact point deviates by more than 150 mm (6 in.) from its original position, or if any other condition exists that would cause the safety of the user to be compromised, results shall be reported as fail.

6.5.4.3 Static Load Test for Failure.

6.5.4.3.1 The Static Load Test for failure shall be set up as specified in 6.5.4.1.

6.5.4.3.2 The device shall be positioned according to manufacturers’ instructions with all surface contact points securely seated before testing.

6.5.4.3.3 A force shall be applied to the portable anchor device, increasing to the load specified in 5.5.4.3 for light-use testing and 5.5.4.5 for general-use testing at a rate of 30 mm/min, ±5 mm/min (1.2 in./min, ±0.2 in./min). The force shall be held for 30 seconds, ±1 second, and then the tension shall be completely released over a maximum of 1 minute.

6.5.4.3.4 At the conclusion of the Static Load Test, the sample portable anchor device shall be inspected to determine pass/fail. A portable anchor device shall be considered to fail if any of the load-bearing members fracture, collapse, or if any condition exists that would cause the user to have been dropped. Results shall be reported as pass or fail.

6.5.5 Pulley Tensile Testing.

6.5.5.1 This test shall apply to both light-use and general-use designated pulleys.

6.5.5.2 At least five randomly selected samples shall constitute a test series for each model of pulley.

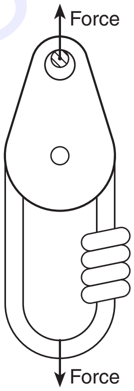
6.5.5.3 Pulleys designated as light use by the manufacturer shall be tested using life safety rope meeting the static rope requirements of Cordage Institute Standard CI 1801, *Low Stretch and Static Kernmantle Life Safety Rope,* with a diameter of 9.5 mm ($^3/_8$ in.).

6.5.5.4 Pulleys designated as general use by the manufacturer shall be tested using life safety rope meeting the static rope requirements of Cordage Institute Standard CI 1801, *Low Stretch and Static Kernmantle Life Safety Rope,* with a diameter of 12.5 mm ($^1/_2$ in.).

6.5.5.5 The rope shall be tied in a loop using a double fisherman's knot and looped around the sheave as shown in Figure 6.5.5.5. Tension shall be applied between the rope loop and a 12.5-mm ($^1/_2$-in.) pin through the pulley carabiner hole at a rate of 30 mm/min, ±5 mm/min (1.2 in./min, ±0.2 in./min) until failure.

FAIR USE

FIGURE 6.5.5.5 Pulley tensile test.



6.5.5.6 Pulleys with two or more sheaves shall have a single rope looped around all sheaves and the load applied to each loop.

6.5.5.7 Pulleys that include a becket at the bottom of the pulley shall have the becket tested by applying a load longitudinally between the carabiner hole and the becket.

6.5.6 Corrosion Testing.

6.5.6.1 Specimens shall be tested in accordance with ASTM B 117, *Standard Practice for Operating Salt Spray (Fog) Apparatus.* Salt spray shall be 5 percent saline solution, and test exposure shall be for 50 hours.

6.5.6.2 Immediately following the test exposure and prior to examination, specimens shall be rinsed under warm, running tap water and dried with compressed air.

6.5.6.3 Specimens shall then be examined visually by the unaided eye with 20/20 vision, or vision corrected to 20/20, to determine pass/fail.

6.5.6.4 Specimens shall be operated in the manner of function to determine pass/fail.

6.5.7 Product Label Permanency Test.

6.5.7.1 Test specimens of synthetic fabric product label samples shall be tested in accordance with ASTM D 4966, *Standard Test Method for Abrasion Resistance of Textile Fabrics.*

6.5.7.2 At least four test specimens shall be cut from product label(s) samples. At least two test specimens shall include the edge of the product label(s).

6.5.7.3 At least two test specimens shall be subjected to 160 dry abrasion revolutions, 10 cycles, and at least two test specimens shall be subjected to 80 wet abrasion revolutions, 5 cycles. At least one dry and one wet test specimen shall be edge specimens.

6.5.7.4 Test specimens shall then be examined visually with the unaided eye to determine pass/fail.

6.5.8 Product Label Heat Resistance Test.

6.5.8.1 The product label specimen to be tested shall be conditioned in accordance with Section 4, Atmospheric Conditions for Testing, of Federal Test Method Standard 191A, *Textile Test Methods*, at a relative humidity of 65 percent, ±5 percent. Specimens shall be tested not more than 5 minutes after removal from conditioning.

6.5.8.2 Specimens shall be suspended in the oven utilizing metal clips.

6.5.8.3 The forced circulating air oven shall achieve and maintain an air temperature of 205°C, +3/−0°C (400°F, +10/−0°F) for a period of not less than 5 minutes. Oven recovery time after the door is closed shall not exceed 1 minute.

6.5.8.4 The product label specimen shall be suspended by metal hooks at the top and centered in the oven so that the entire specimen is not less than 50 mm (2 in.) from any oven surface or other specimen and airflow is parallel to the plane of the material.

6.5.8.5 Specimens, mounted as specified in 6.5.8.4, shall be placed in the circulating air oven for 5 minutes, +0.15/−0 minute. Specimen exposure time shall begin when the oven has recovered to an air temperature of 205°C, +3/−0°C (400°F, +10/−0°F).

6.5.8.6 Results shall be reported as pass or fail.

6.6 Auxiliary Equipment, Manufactured Systems, and System Components Static Testing.

6.6.1 Test Set-Up.

6.6.1.1 Samples of each model of each auxiliary equipment, manufactured system, and system component shall be selected randomly for testing. The testing samples shall be new and in an unused condition and shall conform in all respects to the manufacturers' specifications for the model to be tested. A total of at least two samples of each model of auxiliary equipment, manufactured systems, and system components shall be required for each test specified.

6.6.1.2 If there are multiple load-bearing points, all tests shall be repeated for each combination of load-bearing connecting points specified in the manufacturers' instructions.

6.6.1.3 For all static tests, the device shall be attached to the test machine at the load-bearing connecting point, in accordance with the manufacturers' instructions for use.

6.6.1.4 For all tests, the device shall be positioned in the manner described by the manufacturers' instructions for use in its lowest strength configuration.

6.6.1.5 For all tests, the device shall be accompanied by all equipment required for use as described by the manufacturers' instructions for use.

6.6.1.6 Manufacturers shall designate the device as light use or general use based on the weakest design point. The minimum strength of the device shall be used to confirm the use rating.

6.6.2 Static Test for Failure.

6.6.2.1 The Static Test for Failure shall be set up as specified in 6.6.1.

6.6.2.2 The device shall be positioned according to the manufacturers' instructions with all surface contact points securely seated before testing.

6.6.2.3 A force shall be applied to the auxiliary equipment, manufactured system, or system component increasing to the load specified in 5.5.6.3 or 5.6.3 for light use and 5.5.6.5 or 5.6.5 for general use at a rate of 30 mm/min, ±5 mm/min (1.2 in./min, ±0.2 in./min). The force shall be held for 30 seconds ±1 second, and then the tension shall be completely released over a maximum of 1 minute.

6.6.2.4 At the conclusion of the Static Test for Failure, the sample auxiliary equipment, manufactured system, or system component shall be inspected to determine pass/fail. An auxiliary equipment, manufactured system, or system component shall be considered to fail if any of the load-bearing members fracture or collapse or if any condition exists that would cause the user to have been dropped. Results shall be recorded as pass or fail.

6.7 Throwline.

6.7.1 Minimum Break Testing.

6.7.1.1 Samples of throwline shall be tested for minimum breaking strength in accordance with the test method for minimum breaking strength as specified in Cordage Institute Standard CI 1801, *Low Stretch and Static Kernmantle Life Safety Rope.*

6.7.1.2 New throwline minimum breaking strength shall be determined by subtracting three standard deviations from the mean result of five samples from the same production lot. The standard deviation shall be calculated using the formula:

$$s = \sqrt{\frac{n(\Sigma x^2) - (\Sigma x)^2}{n(n-1)}}$$

where:

s = Standard deviation

n = Number of samples

x = Breaking strength

6.7.1.3 Test results and calculations shall be examined to determine pass/fail.

6.7.2 Floatability Testing.

6.7.2.1 A sample of the throwline shall be selected with a length of at least 1 m (39 in.) and the ends of the sample shall be heat sealed.

6.7.2.2 The sample shall be completely submerged in fresh water for a period of 5 minutes, ±15 seconds and then allowed to float to the surface.

6.7.2.3 After a period of 5 minutes, the rope shall be inspected to determine pass/fail. The throwline shall be considered to have failed this test if no part of the sample has remained above the surface of the water.

Chapter 7 Referenced Publications

7.1 The following documents or portions thereof are referenced within this standard as mandatory requirements and shall be considered part of the requirements of this standard. The edition indicated for each referenced mandatory document is the current edition as of the date of the NFPA issuance of this standard. Some of these mandatory documents might also be referenced in this standard for specific informational purposes and, therefore, are also listed in Appendix B.

7.1.1 NFPA Publication. National Fire Protection Association, 1 Batterymarch Park, P.O. Box 9101, Quincy, MA 02269-9101.

NFPA 1500, *Standard on Fire Department Occupational Safety and Health Program*, 1997 edition.

7.1.2 Other Publications.

7.1.2.1 AATCC Publication. American Association of Textile Chemists and Colorists, P.O. Box 12215, Research Triangle Park, NC 27709.

AATCC Test Method 16, *Colorfastness to Light*, 1998.

7.1.2.2 ANSI Publication. American National Standards Institute, 11 West 42nd Street, 13th floor, New York, NY 10036.

ANSI/UL 913, *Standard for Intrinsically Safe Apparatus and Associated Apparatus for Use in Class I, II, and III, Division 1, Hazardous (Classified) Locations*, 1988.

7.1.2.3 ASTM Publications. American Society for Testing and Materials, 100 Barr Harbor Drive, West Conshohocken, PA 19428-2959.

ASTM B 117, *Standard Practice for Operating Salt Spray (Fog) Apparatus*, 1997.

ASTM D 4966, *Standard Test Method for Abrasion Resistance of Textile Fabrics*, 1989.

ASTM E 794, *Standard Test Method for Melting and Crystallization Temperatures by Thermal Analysis*, 1995.

7.1.2.4 Cordage Institute Publication. The Cordage Institute, 350 Lincoln Street, Hingham, MA 02043.

CI 1801, *Low Stretch and Static Kernmantle Life Safety Rope*, 1998.

7.1.2.5 GSA Publications. General Services Administration, Specifications Activity, Printed Materials Supply Division, Building 197, Naval Weapons Plant, Washington, DC 20407.

Federal Test Method Standard 191A, *Textile Test Methods*, 1978.

MIL-STD 2175A, *Castings, Classification and Inspection of*, 8/25/93.

7.1.2.6 ISO Publications. International Standards Organization, 1 rue de Varembé, Case Postal 56, CH-1211 Geneve 20, Switzerland.

ISO Guide 65, *General requirements for bodies operating product certification systems*, 1996.

ISO 9001, *Quality management systems — Requirements*, 2000.

ISO/IEC 17025, *General requirements for competence of testing and calibration laboratories*, 1999.

Appendix A Explanatory Material

Appendix A is not a part of the requirements of this NFPA document but is included for informational purposes only. This appendix contains explanatory material, numbered to correspond with the applicable text paragraphs.

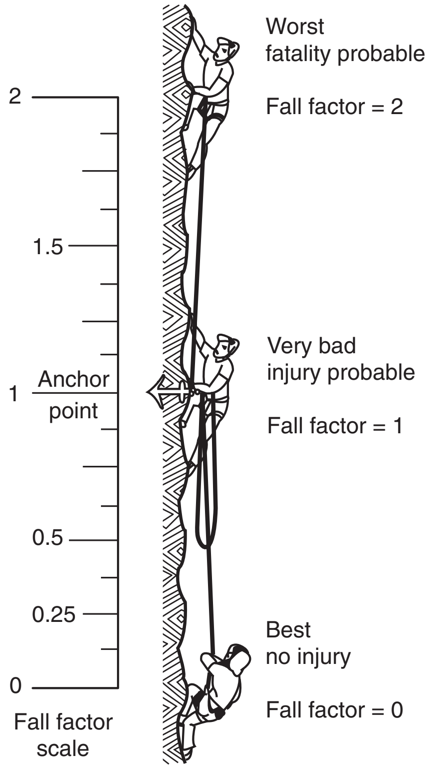
A.1.1.4 Fall factors (as illustrated in Figure A.1.1.4) are calculated by dividing the distance the person attached to the rope will fall by the length of the rope between him and the rope anchor or belay. Thus, a 305-mm (1-ft) fall on a 150-mm ($^1/_2$-ft) rope would be a fall factor of 2.0; a 305-mm (1-ft) fall on a 305-mm (1-ft) rope would be a 1.0-fall factor, a 305-mm (1-ft) fall on a 1.12-m (4-ft) rope would be a 0.25-fall factor, and a 305-mm (1-ft) fall on a 12.2-m (40-ft) rope would be a 0.025-fall factor. Note as well that a 7.6-m (25-ft) fall on a 30.5-m (100-ft) rope is also a 0.25-fall factor. This formula assumes the fall takes place in free air without rope drag across building edges or through intermediate equipment.

When fall factors of greater than 0.25 are anticipated, such as are possible in lead climbing, dynamic ropes specifically designed for climbing should be considered. Only ropes certified to an appropriate climbing rope standard (i.e., UIAA, CE, etc.) are appropriate for this use. Dynamic climbing ropes should be stored, maintained, inspected and use-logged in a manner similar to that required for static/low stretch rope. Such operations are outside the scope of this document.

A.1.2.1 Fire fighting and rescue are hazardous activities. It is the responsibility of the fire department to obtain expert instruction and to take adequate safety precautions based upon manufacturer's recommendations. Fire department training should include use techniques; maintenance procedures, including properties of escape rope, life safety harness, belts, and auxiliary equipment; and deployment techniques of this equipment.

A.1.3.2 Approved. The National Fire Protection Association does not approve, inspect, or certify any installations, procedures, equipment, or materials; nor does it approve or evaluate testing laboratories. In determining the acceptability of installations, procedures, equipment, or materials, the authority having jurisdiction may base acceptance on compliance with NFPA or other appropriate standards. In the absence of such standards, said authority may require evidence of proper installation, procedure, or use. The authority having jurisdiction may also refer to the listings or labeling practices of an organization that is concerned with product evaluations and is thus in a position to determine compliance with appropriate standards for the current production of listed items.

FIGURE A.1.1.4 Fall factor. The severity of a fall is expressed as a ratio calculated by dividing the distance fallen by the length of rope used to arrest the fall. A fall factor of 0.25 is the maximum considered for NFPA 1983.



A.1.3.4 Authority Having Jurisdiction. The phrase "authority having jurisdiction" is used in NFPA documents in a broad manner, since jurisdictions and approval agencies vary, as do their responsibilities. Where public safety is primary, the authority having jurisdiction may be a federal, state, local, or other regional department or individual such as a fire chief; fire marshal; chief of a fire prevention bureau, labor department, or health department; building official; electrical inspector; or others having statutory authority. For insurance purposes, an insurance inspection department, rating bureau, or other insurance company representative may be the authority having jurisdiction. In many circumstances, the property owner or his or her designated agent assumes the role of the authority having jurisdiction; at government installations, the commanding officer or departmental official may be the authority having jurisdiction.

A.1.3.6.1 Escape Belt. The intended use of the escape belt is to provide emergency escape capability to a fire fighter from an immediate life-threatening emergency above the ground floor of a structure. Escape belts do not have leg loops to prevent the belt from rising up the torso of the user. The fire fighter using an escape belt should always be able to maintain foot contact with the surface of the structure during descent or use a life safety harness.

A.1.3.7 Block Creel Construction. Unavoidable knots could be present in individual fibers as received from the fiber producer.

A.1.3.16 Design Load. The design load used in developing the minimum performance requirement of a component to this standard is only applicable when the forces are applied to the component in a direct linear fashion. The loads placed on a component through rigging and creation of a system can be increased due to the vectors used in the rigging. Loads can be amplified substantially when forces are applied in differing directions. Users should develop processes to identify loads placed on each component when creating systems and to determine whether or not they are acceptable. For example, a rope used in a highline system as the main line could be loaded (tensioned) with more than ten times the actual load being carried across on the highline system depending on the angles involved in the rigging of the highline system.

A.1.3.23 Fall Factor. See A.1.1.4.

A.1.3.28 Impact Load. For the purposes of this document, fall factors greater than 0.25 generate unacceptable impact loads.

A.1.3.35 Listed. The means for identifying listed equipment may vary for each organization concerned with product evaluation; some organizations do not recognize equipment as listed unless it is also labeled. The authority having jurisdiction should utilize the system employed by the listing organization to identify a listed product.

A.1.3.42 Portable Anchor. Examples include but are not limited to davits, A-frame, tripods, quadpods, and cantilever devices.

A.1.3.43 Product Label. This product label is not a certification organizations' label, symbol, or identifying mark; however, the certification organizations' label, symbol, or identifying mark can be attached to it or be part of it.

A.1.3.45 Proof Load. The applied proof load is usually well above the allowable service load, but low enough so as not to damage the product being tested.

A.1.3.55 Standard Deviation. In this standard, standard deviation is calculated using the formulas in 6.1.1.2, 6.2.1.2, and 6.6.1.2.

A.2.2.1 The certification organization should have sufficient breadth of interest and activity so that the loss or award of a specific business contract would not be a determining factor in the financial well-being of the agency.

A.2.2.3 The contractual provisions covering certification programs should contain clauses advising the manufacturer that if requirements change, the product should be brought into compliance with the new requirements by a stated effective date through a compliance review program involving all currently listed products. Without the clauses, certifiers would not be able to move quickly to protect their name, marks, or reputation. A product safety certification program would be deficient without these contractual provisions and the administrative means to back them up.

A.2.2.4 Investigative procedures are important elements of an effective and meaningful product safety certification program. A preliminary review should be carried out on products submitted to the agency before any major testing is undertaken.

A.2.2.7 Such inspections should include, in most instances, witnessing of production tests. With certain products, the certification organization inspectors should select samples from the production line and submit them to the main laboratory for countercheck testing. With other products, it could be desirable to purchase samples in the open market for test purposes.

A.3.1.1 Information could be added to the tape that applies to a particular rope, such as date of manufacture or any pertinent information useful to the purchaser.

A.3.1.2.1 When life safety rope is purchased, the authority having jurisdiction should assure that the product label(s) with the information as specified in 3.1.1, 3.1.2, and 3.2.1 is attached and remains with the rope until placed in service. When the product label is removed from the rope, the label should be retained in the authority's permanent rope records.

It is very important that the information on the product label(s) and the information required in 3.2.1 to be supplied by the manufacturer reach the persons who will actually be using the rope. It is useless for the supply personnel or equipment officer to remove the product label and other pertinent information and simply retain them in the rope record file. The persons who potentially will be using the rope need to be provided with all the information that could be available. Copies of the product label(s) and other pertinent information should be maintained with the rope wherever the rope is in-service awaiting use so that the potential users can consult the information.

Where life safety or escape rope is purchased in long lengths, and then cut by the end user agency to make several life safety ropes or escape ropes, the product label(s) should be photocopied or otherwise reproduced and attached to each life safety rope when it is sent into service. The end user person or persons (in a fire department it probably would be a fire company) should keep the copy of the product label(s) and any other pertinent information for reference and have the product label and other information readily available so that they can be reviewed by all potential users whenever necessary.

Ropes can be damaged in use by high stresses, impact loading situations, abrasion, kinking, heat, and exposure to chemicals and other products.

Ropes should be inspected by a qualified person before and after every operation and carefully stored between each use. Records should provide a history of each rope and should call for regular inspection and replacement as necessary. Any rope that fails to pass inspection or has been impact loaded should be destroyed immediately.

It is recommended that departments establish an inspection program and shelf life criteria for their ropes based on the conditions and environments encountered in their respective operations.

It is recommended that training ropes and rescue ropes be separate ropes.

The destruction of rope means that it should be removed from service and altered in such a manner that it could not mistakenly be used as a life safety rope. This could include disposal or removal of the label and cutting the rope into short lengths to be used for utility purposes.

A.3.1.3.1 When escape rope is purchased, the purchaser or the authority having jurisdiction should ensure that a product label with the information as specified in 3.1.1, 3.1.3, and 3.2.2 is attached and remains with the rope until placed in service. This label should be retained either in the authority's rope records or with the user of the rope for reference.

Escape rope is intended *only for emergency self-rescue situations* and cannot be used for other rope rescue situations. Escape rope is designed for one use only and destroyed after any use.

FAIR USE

Escape rope is intended to be carried by a fire fighter or other emergency services personnel, so that it will be available in unanticipated situations from which self-rescue using the rope is the only option. Therefore, the escape rope should be carefully stored and periodically inspected by a qualified person to ensure status and condition of the rope. During inspection, if there is any doubt as to the suitability of the escape rope for use, it should be destroyed immediately and replaced.

A.3.1.3.3 Information useful to the purchaser that applies to a particular rope could be added to the tape.

A.3.1.4.2 For calculating the "fit height," it will be assumed the wearer has a 1015-mm (40-in.) chest.

A.3.1.7.1 Throwlines that are provided to the potential user in water rescue throwbags should include proper instructions of use for the throwbag in accordance with ASTM F 1730, *Guide for Throwing a Water Rescue Throwbag*.

A.3.2.1 When life safety rope is purchased, the authority having jurisdiction should assure that the product label(s) with the information as specified in 3.1.1, 3.1.2, and 3.2.1 is attached and remains with the rope until placed in service. When the product label is removed from the rope, the label should be retained in the authority's permanent rope records.

It is very important that the information on the product label(s) and the information required in 3.2.1 to be supplied by the manufacturer reach the persons who will actually be using the rope. It is useless for the supply personnel or equipment officer to remove the product label and other pertinent information and simply retain them in the rope record file. The persons who potentially will be using the rope need to be provided with all the information that could be available. Copies of the product label(s) and other pertinent information should be maintained with the rope wherever the rope is in-service awaiting use so that the potential users can consult the information.

Where life safety or escape rope is purchased in long lengths, and then cut by the end user agency to make several life safety ropes or escape ropes, the product label(s) should be photocopied or otherwise reproduced and attached to each life safety rope when it is sent into service. The end user person or persons (in a fire department it probably would be a fire company) should keep the copy of the product label(s) and any other pertinent information for reference and have the product label and other information readily available so that they can be reviewed by all potential users whenever necessary.

FAIR USE

A.3.2.1.3(1) To avoid possible damage, and possible reduction and loss of strength of the life safety rope or harness, the manufacturer should be contacted prior to disinfecting or cleaning by a method not prescribed in the maintenance procedures and retirement criteria.

Generic inspection information for some types of life safety ropes can be found in ASTM F 1740, *Guide for Inspection of Nylon, Polyester and/or Nylon/Polyester Blend Kernmantle Rope.*

A.3.2.2.2(3) The term *destroy* for the escape rope means that it should be removed from service and destroyed by cutting it into less than 305-mm (1-ft) pieces, burning it, or otherwise ruining the rope to prevent reuse.

A.3.2.5.5 Many portable anchor auxiliary equipment devices (such as tripods) have several height or length adjustments at which they can be set up. The strength rating of such devices can be different at each setting. As a minimum, the lowest strength set-up configuration of the device, as recommended by the manufacturer in the user instructions, should be tested and labeled on each device.

A.4.1.1 If a finish is applied to rope fiber during production, it should not interfere with safe usage of the rope due to excessive slipperiness; this characteristic should be evaluated by the purchasing organization before the rope is purchased.

A.4.2.1 See A.4.1.1.

A.4.3.2 The purchaser should ensure that proper sizes are available to accommodate on-duty personnel.

A.4.3.3 Many life safety harness and system components that meet the requirements of this standard might not interface effectively with all systems of use and all types of life safety rope. Evaluation should be done before purchase to ensure compatibility.

Load-bearing textile materials should have strength, aging, ultraviolet resistance, abrasion resistance, and heat and cold resistance characteristics equivalent or superior to polyamides.

A.4.3.4 Alternative methods for finishing and securing webbing ends can be hardware capping, tucking and sewing, and coating the webbing ends with an air-drying solvent base sealant.

A.4.3.5 To aid the visual inspection of thread, it is recommended that the manufacturer use a thread that is of contrasting color to the webbing.

A.4.4.2 See A.4.3.2.

A.4.4.3 See A.4.3.3.

A.4.4.4 See A.4.3.4.

A.4.4.5 See A.4.3.5.

A.4.5.2.2 It is recommended that rescue personnel use general use instead of light-use auxiliary equipment in those one-person load situations where the victim is the load, and in any situations where unusual or extreme forces could be placed on the system.

A.4.5.2.3 See A.4.5.2.2.

A.4.5.6 Locking designs can include screw and spring collars that are designed to prevent gates from opening accidentally during use.

A.4.5.9 See A.4.3.5.

A.5.1 Even properly stored rope can lose strength over a period of time. Life safety ropes should be stored in a manner to avoid degradation from the environment. Examples include but are not limited to sunlight, fluorescent light, heat, exhaust fumes, battery acid, and fumes.

Any rope can be severely damaged and can fail when cut by a sharp edge or when subjected to abrasion over rough surfaces. Rope should be protected from such hazards with appropriate abrasion protection. Many constructions of rope that meet the requirements of this standard could pose difficulties with knotting or splicing easily or interfacing effectively with all systems of use and all types of life safety harness and associated equipment. Evaluation should be done by the fire department before purchase to ensure compatibility. Rope end terminations such as knots and splices should be made in accordance with the manufacturer's instructions.

A.5.1.3 Rope elongation is related to the amount of energy a rope can safely absorb when used to arrest a fall. For all ropes, and especially when impact loading of greater than a fall factor of 0.25, manufacturers should be consulted to assure that rope with appropriate elongation and energy absorption is selected for each application.

A.5.1.4 See A.5.1.3.

A.5.1.5 Table A.5.15 shows comparisons of rope diameters to circumference in both millimeters and inches.

Table A.5.15 Comparison of Rope Diameter/Circumference

Diameter in Decimal (mm) Nearest 0.5 mm	Diameter in Decimal (in.)	Diameter in Fraction (in.) nearest $^1/_{64}$	Equivalent Circumference (in.)
7.5	0.295	$^{19}/_{64}$	0.93
8.0	0.313	$^{5}/_{16}$	0.98
8.5	0.335	$^{11}/_{32}$	1.05
9.5	0.376	$^{3}/_{8}$	1.18
10.0	0.394	$^{25}/_{64}$	1.24
10.5	0.413	$^{13}/_{32}$	1.30
11.0	0.433	$^{7}/_{16}$	1.36
11.5	0.453	$^{29}/_{64}$	1.42
12.0	0.472	$^{15}/_{32}$	1.48
12.5	0.492	$^{1}/_{2}$	1.55
13.0	0.513	$^{33}/_{64}$	1.61
16.0	0.630	$^{5}/_{8}$	1.98

When selecting the size of rope to purchase, a systems approach should be considered. Evaluation should be done while wearing gloves with the selected ascender and descender auxiliary equipment before purchase to ensure the rope size works.

FAIR USE

A.5.1.6 See A.5.1.5

A.5.1.7 The thermal requirement is intended to limit melting of rope, harness, and certain other system components due to friction caused by activities such as rappelling. The thermal requirement is NOT intended to qualify these items for use during fire-fighting operations or other operations where high temperature exposures are encountered.

Many life safety ropes have thermoplastic materials as all or part of their construction because of the material's excellent stretch and resilient properties. However, thermoplastic materials are not highly resistant to elevated temperatures and can lose strength at temperatures common during fire-fighting operations. If life safety rope is carried by fire fighters during fire-fighting operations, it should be shielded or protected from flame or high temperature exposures. Repeat exposures of the life safety rope to flame or high temperatures can cause degradation of the rope over time and could result in failure during use. Exposure of the life safety rope to flame or high temperatures during use can cause melting of thermoplastic materials of the rope and result in failure.

A.5.2 See A.5.1.

A.5.2.2 See A.5.1.3.

A.5.2.3 See A.5.1.5.

A.5.2.4 The thermal requirement is intended to limit melting of rope, harness, and certain other system components due to friction caused by activities such as rappelling. The thermal requirement is NOT intended to qualify these items for use during fire-fighting operations or other operations where high temperature exposures are encountered.

Many escape ropes have thermoplastic materials as all or part of their construction because of the material's excellent stretch and resilient properties. However, thermoplastic materials are not highly resistant to elevated temperatures and can lose strength at temperatures common during fire-fighting operations. If escape rope is carried by fire fighters during fire-fighting operations, it should be shielded or protected from flame or high temperature exposures and falling hot debris. The rope can be carried in the pocket of the protective coat or inside a thermally protective pouch or storage bag. Repeat exposures of the escape rope to flame or high temperatures can cause degradation of the rope over time and could result in failure during use. Exposure of the escape rope to flame or high temperatures during use can cause melting of thermoplastic materials of the rope and result in failure.

A.5.3.5 The thermal requirement is intended to limit melting of rope, harness, and certain other system components due to friction caused by activities such as rappelling. The thermal requirement is NOT intended to qualify these items for use during fire-fighting operations or other operations where high temperature exposures are encountered.

Many life safety harness have thermoplastic materials as all or part of their construction because of the material's excellent strength and resilient properties. However, thermoplastic materials are not highly resistant to elevated temperatures and can lose strength at temperatures common during fire-fighting operations. If life safety harness is carried or used by fire fighters during fire-fighting operations, it should be shielded or protected from flame or high temperature exposures. Repeat exposures of the life safety rope to flame or high temperatures can cause degradation of the harness over time and could result in failure during use. Exposure of the life safety harness to flame or high temperatures during use can cause melting of thermoplastic materials of the harness and result in failure.

A.5.4.4 The thermal requirement is intended to limit melting of rope, harness, and certain other system components due to friction caused by activities such as rappelling. The thermal requirement is NOT intended to qualify these items for use during fire-fighting operations or other operations where high temperature exposures are encountered.

Many belts have thermoplastic materials as all or part of the construction because of the excellent strength and resilient properties. However, thermoplastic materials are not highly resistant to elevated temperatures and can lose strength at temperatures common during fire-fighting operations. If belts are carried or used by fire fighters during fire-fighting operations, they should be shielded or protected from flame or high temperature exposures. Repeat exposures of belts to flame or high temperatures can cause degradation of the belt over time and could result in failure during use. Exposure of the belt to flame or high temperatures during use can cause melting of thermoplastic materials of the belt and result in failure.

A.5.5.6.5 The thermal requirement is intended to limit melting of rope, harness, and certain other system components due to friction caused by activities such as rappelling. The thermal requirement is NOT intended to qualify these items for use during fire fighting operations or other operations where high temperature exposures are encountered.

Many auxiliary equipment software items have thermoplastic materials as all or part of the construction because of the excellent strength and resilient properties. However, thermoplastic materials are not highly resistant to elevated temperatures and can lose strength at temperatures common during fire fighting operations. If auxiliary equipment software items are carried by fire fighters during fire fighting operations, they should be shielded or protected from flame or high temperature exposures. Repeat exposures of the auxiliary equipment software to flame or high temperatures can cause degradation of the item(s) over time and could result in failure during use. Exposure of the auxiliary equipment software to flame or high temperatures during use can cause melting of thermoplastic materials of the item(s) and result in failure.

A.6.1.1.1 NFPA 1983 does not preclude a variety of rope construction so long as the construction types meet the performance requirements of the standard. The title of CI 1801, *Low Stretch and Static Kernmantle Life Safety Rope*, indicates a type of rope construction; however, the elongation and breaking strength test methods contained in CI 1801 can be utilized for other types of rope construction.

The reference is not intended to limit the rope construction to any single type of rope construction or to the construction type mentioned in the title of CI 1801. The reference is only intended to reference the testing methods for elongation and breaking strength specified in Sections 8 and 9 of CI 1801 for evaluating any rope construction type for compliance with NFPA 1983.

A.6.3.1.1 The intent is to test three samples of each model per test. At the manufacturers' discretion, a new, unused sample from one test series can be used for one or more of the other test series. For example, a sample used in harness test 6.3.2 can be used to conduct harness test 6.3.3, or a new unused sample can be used.

A.6.3.2.3 The 16.01-k/N (3600-lbf) test value selected for this static test, which employs a rigid test torso, equates to having a dynamic force exerted on the body greatly exceeding that which is considered reasonable to survive.

A.6.3.3.3 The force selected for this test is less than that selected for the previous test because, in realistic emergency operations, a fire fighter falling headfirst will impact the harness with less force in the head-down position, and then be inverted and arrested, thus producing the maximum force in the upright position.

A.6.4.1.1 See A.6.3.1.1.

A.6.4.2.3 A lesser force is used in this test than in the rescue harness test due to the personal protective application of belts. The indicated test force of 13 k/N (2923 lbf) is compliant with the requirements for escape rope.

A.6.5.1.2.1 AISI SAE Type 01 tool steel is commonly purchased as 01 Drill Rod.

A.6.5.4.1.4 For example, portable anchors designed to be attached to flanged rims of vessel openings would require a test base to simulate the flanged portal to which the device is designed to be affixed.

A.6.5.4.1.6 In most cases, the portable anchor device will be weakest at its greatest (or highest) extension.

Appendix B Referenced Publications

B.1 The following documents or portions thereof are referenced within this standard for informational purposes only and are thus not considered part of the requirements of this standard unless also listed in Chapter 7. The edition indicated here for each reference is the current edition as of the date of the NFPA issuance of this standard.

B.1.1 ASTM Publications. American Society for Testing and Materials, 100 Barr Harbor Drive, West Conshohocken, PA 19428-2959.

ASTM F 1730, *Guide for Throwing a Water Rescue Throwbag*, 1996.

ASTM F 1740, *Guide for Inspection of Nylon, Polyester and/or Nylon/Polyester Blend Kermantle Rope*, 1996.

B.1.2 Cordage Institute Publication. The Cordage Institute, 350 Lincoln Street, Hingham, MA 02043.

CI 1801, *Low Stretch and Static Kermantle Life Safety Rope*, 1998.

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